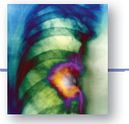

Timeliness of Lung Cancer Diagnosis and Treatment

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Most patients received timely histopathologic confirmation of diagnosis, but surgery candidates faced significant delays in care in this quality improvement analysis.

Lung cancer is the leading cause of cancer-related deaths worldwide and causes more deaths than do colorectal, breast, and prostate cancers combined.[1] An estimated 155,870 Americans are expected to die of lung cancer in 2017, and these deaths account for about 26% of all cancer deaths.[1] The overall 5-year survival rate for patients with lung cancer is 16.8%.[2] However, this rate varies considerably, from 54% for those with early-stage cancer to 26.5% for those with locally advanced cancer and 4% for those with distant metastases.[2]

The Institute of Medicine's Committee on Quality Health Care in America recognized timeliness of care as 1 of 6 important dimensions of health care quality.[3] Delays in timely diagnosis and treatment of cancer, especially lung cancer, can result in significant emotional distress, impaired quality of life, increased use of health care resources, and, arguably, increased cost of care.[4] In addition, delayed diagnosis of cancer can lead to negligence litigation.[4]

In the U.S., there are no federal standardized guidelines regarding timeliness of lung cancer care. In 2000, the RAND Corporation, a research organization, published several quality indicators recommending lung cancer diagnoses be established within 2 months after initial abnormal chest radiographs and treatment be offered within 6 weeks after diagnosis.[5]

Using these recommendations as benchmarks, a quality improvement study was conducted to determine the time lines of comprehensive lung cancer care at the Dayton VAMC in Ohio. The primary aim of the study was to evaluate adherence to the RAND criteria (the only U.S.-based guidelines) for the diagnosis and treatment of lung cancer in Dayton VAMC patients. The secondary aim was to assess the effect of preoperative cardiopulmonary rehabilitation on timeliness of treatment. The authors plan to use the results of the study to guide and improve cancer practices at the Dayton VAMC.

METHODS

The authors conducted a retrospective study of a series of 121 consecutive patients who had lung cancer that was confirmed at the Dayton VAMC with a cytohistologic diagnosis between January 2011 and December 2013. The study was approved by the Dayton VAMC Research and Development committee and the Wright State University Institutional Review Board. After data collection and review, all patient identifiers were replaced with sequential numbering.

The Dayton VAMC is a 356-bed facility serving 16 counties and > 50,000 patients. Lung cancer diagnosis and management are collaboratively undertaken by various Dayton VAMC departments, including pulmonology, radiology, interventional radiology, pathology, thoracic surgery, medical oncology, radiation oncology, and palliative care. The facility, fully equipped with scanners for positron emission tomography and magnetic resonance imaging, provides comprehensive cancer care without the need for referrals to outside facilities for any part of care from diagnosis to end of life.

The study patients were identified from the Dayton VAMC tumor registry. Patients with only biopsy-confirmed

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malignancy were included in the study. Patients who did not follow up before biopsy or did not pursue treatment after biopsy confirmation were excluded from analysis where appropriate.

Patient data collected included age, sex, presenting symptom, histology, cancer stage, treatment modality, cardiopulmonary rehabilitation, and if applicable, tumor size. Patients were retrospectively followed for 3 years. Charts reviewed did not include outcomes information. Historically, delays have been categorized as provider delays, patient delays, or system delays. Provider delay stems from the primary care provider's (PCP) failure to investigate a presenting symptom further, patient delay from the patient's failure to seek medical care or to follow through on medical advice in a timely manner, and system delay from the health care organization's failure to obtain imaging or biopsy results in a timely manner. Assessment of system delay is focused on quality improvement at a treatment center.

In the present study, the primary aim was to assess system delay. The authors analyzed delay during 3 different periods: time to diagnosis (interval from date an abnormality was found on chest radiograph or computed tomography scan to date of tissue diagnosis); time to treatment initiation (interval from date of histopathologic diagnosis to date of treatment initiation); and time from date of initial abnormal imaging to date of treatment initiation. With RAND criteria applied, time to diagnosis longer than 60 days was considered diagnostic delay, time to treatment longer than 42 days was considered treatment delay, and the sum of these periods (102 days) was considered total delay.[5] Patients with diagnosis and treatment intervals that fell within these criteria were considered in adherence with the RAND criteria.

Means and standard deviations were reported for continuous variables and counts and percentages for categoric variables. Calculations were performed with IBM SPSS 21.0 (Armonk, NY).

RESULTS

Of the 121 patients, 118 (97.5%) were men, and 3 (2.5%) were women. Mean (SD) age was 68.5 (8.9) years (range, 50-89 years). Of the 121 patients, 88 (73%) opted to be treated at Dayton VAMC, and the other 33 opted to receive palliative care only (20) or to be treated at an outside facility (13). The group of 33 patients was included in the analyses of diagnostic delay but not treatment delay (Table 1).

Table 1. Clinical Characteristics (N = 121)

Characteristics	n	%
Sex		
Male	118	97.5
Female	3	2.5
Histology		
Adenocarcinoma	40	33.1
Squamous cell	57	47.1
Non-SCLC, not otherwise specified	10	8.3
SCLC	11	9.1
Mesothelioma	1	0.8
Other	2	1.7
Stage[a]		
I	33	28.7
II	8	6.9
IIIA	16	13.9
IIIB	14	12.2
IV	33	28.7
Limited-stage SCLC	3	2.6
Extensive-stage SCLC	8	7.0
Primary treatment modality		
Surgery	19	15.7
Chemotherapy	15	12.4
Radiation	26	21.5
Chemoradiation	28	23.2
Palliative care	20	16.5
Outside Dayton VAMC	13	10.7

Abbreviation: SCLC, small cell lung cancer.
[a]Staging was not completed for 6 patients who elected treatment either outside Dayton VAMC or only palliative care.

Mean (SD) time to diagnosis was 35.5 (31.6) days (n = 111), mean (SD) time to treatment was 55.9 (46.3) days (n = 87), and mean (SD) total time was 92.7 (62.1) days (n = 82). Table 2 lists data regarding adherence to RAND guidelines for diagnostic delay (diagnostic timeliness), treatment delay (treatment timeliness), and total delay (total timeliness) for 3 groups of patients: all patients, and those who did and did not participate in cardiopulmonary rehabilitation. Of all patients, 82.9% met the RAND diagnostic time standard, 51.7% met the treatment time standard, and 61.0% met the total time standard. As

Table 2. Adherence to RAND Guidelines (N = 121)

Group	Timeliness[a]		
	Diagnostic, %	Treatment, %	Overall, %
All patients	82.9	51.7	61.0
No cardiopulmonary rehabilitation	89.2	58.6	72.3
Cardiopulmonary rehabilitation only	50.0	23.5	17.6

[a]Diagnostic, ≤ 60 days from abnormal imaging to diagnosis; treatment, ≤ 42 days from diagnosis to treatment; overall, ≤ 102 days from abnormal imaging to treatment.

Table 3. Adherence to RAND Guidelines in Patients Who Did Not Participate in Cardiopulmonary Rehabilitation

Treatment Modality	Timeliness[a]		
	Diagnostic, %	Treatment, %	Overall, %
All patients	89.2	58.6	72.3
Surgery	14.3	25.0	0.0
Radiation	94.7	76.2	84.2
Chemotherapy	92.9	40.0	78.6
Chemoradiation	100	65.4	80.0

[a]Diagnostic, ≤ 60 days from abnormal imaging to diagnosis; treatment, ≤ 42 days from diagnosis to treatment; overall, ≤ 102 days from abnormal imaging to treatment.

expected, the proportions of patients meeting the RAND standards were higher for the group that participated in cardiopulmonary rehabilitation: 89.2%, 58.6%, and 72.3% for diagnostic, treatment, and total time, respectively.

Table 3 lists data regarding adherence to RAND guidelines by treatment modality, excluding the patients who participated in cardiopulmonary rehabilitation. With the exception of surgery only, all other primary treatment modalities were marked by 90% or higher adherence in meeting diagnostic timeliness. However, treatment initiation adherence was lower: 40% to 76.2% in the nonsurgical groups and 25% in the surgery group.

The cardiopulmonary rehabilitation group was analyzed separately (Table 4). Overall, 50% of the patients in this group met the RAND diagnostic time standards and 23.5% met the treatment time standards. There was no clear improvement pattern for these patients when stratified by treatment modality.

For diagnostic time, patients with advanced-stage (IIIB/IV) disease and patients with small cell lung cancer (SCLC) had adherence of at least 87.5%, and patients with stage II/IIIA disease had adherence of at least 80% (Table 5). However, only 62.5% of patients with stage I disease were adherent to the diagnostic guideline. Patients with stage IIIA/IV disease and patients with SCLC had the best performance for the treatment guideline, with no group < 60% adherent. Only 14.3% of patients with stage II disease met the criterion for treatment time, with 42.3% of stage I patients and 44.4% of stage IIIB patients meeting the treatment time goal.

DISCUSSION

Several international study groups have recommended establishing standards for timely care of patients with known or suspected lung cancer.[5-10] According to a study in Brazil, an application interval exceeding 30 days is considered patient delay.[6] The Swedish Lung Cancer Study Group recommended that diagnostic tests be completed within 4 weeks in 80% of all patients and that treatment be started within 2 weeks thereafter.[7] The recommendations from Canada are a maximum of 4 weeks between first PCP visit and diagnosis and 2 weeks for surgery.[8] The British Thoracic Society recommended that all patients have completed diagnostic tests within 2 weeks of request with specific time intervals for treatment initiation based on treatment modality.[9]

Numerous studies[10-27] and 2 meta-analyses[28,29] have addressed timeliness of care or associations between timeliness and clinical outcomes, and 1 study[27] tested an intervention to improve timeliness of care in patients with lung cancer. These studies varied in important ways because of the complexities inherent in the diagnosis and management of lung cancer, patient- and system-specific factors, and the definitions used for "delays."

For this study, the authors examined Dayton VAMC adherence to RAND guidelines regarding time from imaging to diagnosis, time from diagnosis to treatment initiation, and time from abnormal imaging to treatment initiation. Separately, the authors examined the impact of cardiopulmonary rehabilitation on delay.

Table 4. Adherence to RAND Guidelines in Patients Who Participated in Cardiopulmonary Rehabilitation

Treatment Modality	Timeliness[a]		
	Diagnostic, %	Treatment, %	Overall,%
All patients	50.0	23.5	17.6
Surgery	45.5	36.4	18.2
Radiation	75.0	0.0	0.0
Chemotherapy	—	—	—
Chemoradiation	50.0	0.0	50.0

[a]Diagnostic, ≤ 60 days from abnormal imaging to diagnosis; treatment, ≤ 42 days from diagnosis to treatment; overall, ≤ 102 days from abnormal imaging to treatment.

The 89.2% adherence to RAND diagnostic time guidelines (avoiding diagnostic delay) in this study's population (excluding patients who participated in cardiopulmonary rehabilitation) was better than the 59% and 68.8% found in 2 larger VAMC studies.[24,26] In addition, adherence to the RAND time standard for the interval from diagnosis to treatment initiation (avoiding treatment delay) was similar between this study (58.6%) and one of those studies (62.2%), which was a multicenter investigation.[26] The other VAMC study, a single-institution investigation, was superior to the present study with respect to avoiding treatment delay (adherence, 76% vs 58.6%).[24] These overtly similar results suggest that system delay is accompanied by patient delay involving time for decision making, acute illness, missed appointments, and so forth.

In this study, timeliness was most disappointing for the patients who underwent primary surgical resection. Surgery patients' poor diagnostic timeliness rate (14.3%) was likely multifactorial, involving additional pretissue procurement staging workup, including more imaging scans, invasive procedures (mediastinoscopy), and repeat biopsy in cases of negative initial biopsy results. In addition, patients who initially qualified for definitive surgical resection of early-stage lung cancer likely underwent extensive postdiagnostic workup that included pulmonary function testing, split-function studies, and preoperative assessment for cardiac clearance. In a single-center prospective study, O'Rourke and Edwards found that progression of early-stage lung cancer after a median system delay of 94 days resulted in decreased candidacy for curative therapy in 21% of patients.[22]

Surgical resection was previously thought to be the best curative option for early-stage lung cancer. However, recent data on use of stereotactic ablative radiotherapy (SABR) in early-stage non-SCLC (NSCLC) showed equivalent outcomes. In a pooled study, Chang and colleagues found 3-year overall survival of 95% in their SABR group and 79% in their surgery group.[30] Given these data, findings from this study, and significant delays experienced by surgery patients, it is worth considering whether SABR should be used more often.

The benefits of preoperative cardiopulmonary rehabilitation in the surgical outcomes of patients with lung cancer have been well described.[31-36] Bobbio and colleagues noted that short-term cardiopulmonary rehabilitation might improve the surgical candidacy of patients with chronic obstructive pulmonary disease.[34] Moreover, Benzo and colleagues reported that 10 rehabilitation sessions resulted in shorter chest tube time and decreased length of stay, both of which lower postoperative morbidity and cost.[33]

In this study, although patients who had preoperative cardiopulmonary rehabilitation experienced diagnostic delays for reasons similar to those found for patients who did not have cardiopulmonary surgery, rehabilitation led to significant delays in treatment initiation, and more than three-fourths of patients experienced delay. This delay was hardly unexpected, but only 11 of the 18 patients who had preoperative cardiopulmonary rehabilitation underwent surgical resection. As anticipated, rehabilitation did not improve the surgical candidacy of the other patients.

Regarding staging, this study is consistent with international studies in which advanced-stage NSCLC and SCLC cases were diagnosed earlier, presumably because of the associated symptom burden.[15,20,23] These results are also comparable to those of previous VAMC studies.[24-26]

The authors of this quality improvement study will apply its findings when they appoint a cancer care coordinator (nurse coordinator or clinical nurse specialist) at Dayton VAMC. The services of a cancer care coordinator have significantly reduced system delay elsewhere. The VA Connecticut Healthcare System added a cancer care coordinator in 2007, and by 2010, time from lung

Table 5. Adherence to RAND Guidelines

Stages	Timeliness[a]		
	Diagnostic, %	Treatment, %	Overall, %
I	62.5	42.3	38.5
II	83.3	14.3	20.0
IIIA	80.0	66.7	72.7
IIIB	91.7	44.4	62.5
IV	100	62.5	82.6
Limited-stage SCLC	100	66.7	66.7
Advanced-stage SCLC	87.5	60.0	100

Abbreviation: SCLC, small cell lung cancer.
[a]Diagnostic, ≤ 60 days from abnormal imaging to diagnosis; treatment, ≤ 42 days from diagnosis to treatment; overall, ≤ 102 days from abnormal imaging to treatment.

cancer suspicion to treatment was reduced to 55 days from 136 days in 2003.[27]

Limitations

First, the study was retrospective and used a small sample from a single institution; therefore, the results may not be generalizable to other health care settings. Second, the study included a small but significant number of patients who underwent serial imaging for asymptomatic pulmonary nodules; including this subgroup in the analyses of diagnostic delay negatively affected the results. Third, the effect of delay on survival was not evaluated.

CONCLUSION

This quality improvement lung cancer delay study examined adherence to the diagnostic and treatment time intervals recommended by the RAND Corporation in 2000.[5] Although most of its patients received histopathologic confirmation within prespecified parameters, significant delays occurred for surgical patients, presumably as a result of extensive preoperative testing and optimization. Without improved surgical candidacy for most patients enrolled in preoperative cardiopulmonary rehabilitation, the authors urge facilities to consider alternatives to surgery. Given recent advances in SABR outcomes in early-stage NSCLC, SABR is worth considering as an upfront option in cases of equivocal performance status or early-stage NSCLC.

The authors will use information from this study as a baseline at the Dayton VAMC. Planned changes include appointment of a cancer care coordinator and increased awareness of system delay. Already under way is a follow-up study of the utility of this intervention. ●

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