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Increasing access to medical oncology consultation in older patients with stage II–IIIA non-small-cell lung cancer

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Abstract

Background—Resectable non-small-cell lung cancer (NSCLC) was once considered a disease whose sole therapy was surgical resection. Therefore it was managed by surgeons. However, with growing evidence of the benefit of adjuvant chemotherapy, such patients should also be evaluated by a medical oncologist.

Methods—Using data from the Surveillance, Epidemiology, and End Results (SEER) Program, we identified 3,196 patients 66–85 years of age with stage II or IIIA NSCLC who underwent resection between 1992 and 2002 in the United States. We examined the trend in medical oncology consultation to identify predictors associated with oncology consultation and subsequent use of adjuvant chemotherapy, using modified Poisson regression.

Results—From 1992 to 2002, 1,521 patients (47.6%) with resected stage II or IIIA NSCLC were seen by a medical oncologist within 4 months of diagnosis. Strong predictors for medical oncology referral included: being younger, married, having an advanced tumor, adenocarcinoma histology, receiving radiation, and certain SEER geographic regions. The proportion of patients seen by a medical oncologist more than doubled over the ten-year study period, from 28.4% in 1992 to 57.7% in 2002 ($P < 0.001$). The use of adjuvant chemotherapy rose similarly in this

population. Chemotherapy use varied significantly by patient characteristics, including age, marital status, and geographic region. This variation decreased, however, when analysis was restricted to those seen by a medical oncologist within four months of diagnosis.

Conclusions—Our results demonstrate that the role of a medical oncologist as part of the multidisciplinary management of resected NSCLC increased over time, greatly reducing variation in NSCLC management.

Keywords

Non-small-cell lung cancer (NSCLC); Medical oncology consultation; Adjuvant chemotherapy; SEER-Medicare database

Introduction

Lung cancer is the leading cause of cancer-related death in both men and women, accounting in 2006 for an estimated 160,390 deaths in the United States [1] and over one million deaths worldwide [2]. About 85% of cases are non-small cell lung cancer (NSCLC), which has a 5-year survival rate of 15%. Historically, NSCLC, like all solid tumors, was considered a surgical disease, treated by surgery, alone or with postoperative thoracic irradiation [3]. Thus, most patients were managed exclusively by a surgeon as the primary treating physician. The benefit of adjuvant chemotherapy has been accepted for several solid tumors, but acceptance has been slow for NSCLC. Acceptance was not forthcoming until 2003, when results from four phase III randomized clinical trials using modern chemotherapy regimens demonstrated a significant overall survival benefit with adjuvant chemotherapy, a benefit similar to that seen in breast and colon cancers [4, 5, 6, 7].

In this population-based study of patients aged 66–85 with resectable stage II–IIIA NSCLC, we examined the pattern of medical oncology consultation during the period 1992 to 2002, identified factors associated with this pattern, and determined the pattern's impact on use of adjuvant chemotherapy for resected stage II–IIIA NSCLC.

Methods

Data sources

We used the Surveillance, Epidemiology, and End Results (SEER)—Medicare data for this analysis. The SEER program collects uniformly reported data from 11 population-based cancer registries covering approximately 14% of the US population [8]. For each incident cancer, the SEER registries collect information on patients' tumor characteristics, demographic characteristics, and month and year of diagnosis. Since 1991, SEER data have been merged with Medicare administrative data by a matching algorithm that has successfully linked files for more than 94% of SEER registry patients diagnosed at age 65 years.

Study cohort

Eligible patients for the study were Medicare beneficiaries 66–85 years of age at the time of diagnosis who underwent resection for stage II–IIIA NSCLC in 1992–2002 ($n = 3196$).

Patients were excluded if they (a) were not continuously enrolled in both Medicare Parts A and B, or (b) were health maintenance organization (HMO) members over the period from before NSCLC diagnosis through four months after NSCLC diagnosis ($n = 1599$ for all exclusions).

Identification of staging and surgical procedures

We defined resection surgery as wedge resection, pneumonectomy or lobectomy occurring within four months after diagnosis of NSCLC from the site specific surgery code in both the SEER and Medicare claims. International Classification of Diseases (9th revision, clinical modification [ICD-9-CM]) and Current Procedural Terminology (CPT) codes were taken from outpatient and inpatient billing claims and used to define the following procedures: pneumonectomy (ICD9-CM 32.50, 32.60, and CPT 32440, 32442, 32445); lobectomy (ICD9-CM 32.40, and CPT 32480, 32482, 32484, 32486); and wedge resection (ICD9-CM 32.29, 32.30, and CPT 32500).

Variables

Tumor grade and stage were determined from the SEER data. We also used the SEER data to determine patients' sociodemographic characteristics (i.e., race/ethnicity, marital status, and age) at the time of diagnosis. In addition, socioeconomic status of patients' Census tract was measured by determining percent of residents living at or below the poverty level. Because the time studied was 1992–2002, these Census estimates were calculated as average values from the 1990 and 2000 Census years combined.

Patients' preoperative comorbidity level was determined from claims data using the Charlson Comorbidity Index [9].

Identification of patients with a medical oncology consultation

We identified a medical oncology consultation when a patient had a physician claim within the four-month period from the month of diagnosis where the physician specialty was medical oncology or hematology based on CMS data. Physician claims have a two-digit CMS provider code (90 for medical oncologist, 83 for hematology oncologist) that represents the specialty to the carrier processing the claim [10].

Identification of patients receiving chemotherapy

A patient was identified as receiving chemotherapy if he/she had one or more chemotherapy claim within four months after NSCLC diagnosis. We chose the 120-day window to differentiate initial adjuvant treatment from treatment at relapse. In addition, we searched for evidence of other chemotherapy delivery using Level II HCPCS (J9XXX, 96400–96549), ICD-9-CM diagnostic (V581, V662, V672), revenue (0331, 0332, 0335) and procedure codes (9925) from physician claims files or outpatient or admission hospital claims. For patients without specific J9XXX chemotherapy HCPCS codes, these codes were used to capture evidence that an unspecified chemotherapeutic drug had been given during the 120 days after diagnosis. Radiation therapy was defined as CPT codes of 77401–77499, 77750–77799, ICD-9 procedure codes of 9221–9229, ICD-9 diagnosis codes of V580, V661, V671, and revenue codes of 0330, 0333 [9].

Statistical analysis

Statistical analyses were performed to examine the pattern and trend of medical oncology consultation, identify factors related to medical oncology consultation, and examine the effects of medical oncology referral on receipt of chemotherapy. A series of modified Poisson regression models were constructed to estimate the likelihood of medical oncology referral after successively including groups of variables representing: (1) sociodemographic characteristics, (2) tumor characteristics and SEER registry area, and (3) comorbidity and contextual factors. Modified Poisson regression models were also generated to determine likelihood of receiving chemotherapy. All statistical analyses were performed with SAS software version 9.13 for Windows XP (SAS Institute, Inc., Cary, NC).

Results

Table 1 presents the demographic and tumor characteristics of 3,196 patients with resected stage II or IIIA NSCLC diagnosed during 1992–2002 who met study eligibility criteria. The median age of the cohort was 72 years, with a range of 66–85 years. Of all patients, 55.6% were male, 86.4% were white, 5.1% were black, and 3% were Hispanic. Most patients had no comorbidities (66.8%).

Of all patients studied, 47.6% had a medical oncology consultation within four months of diagnosis. Figure 1 illustrates the increase over time of stage II or IIIA NSCLC patients who had medical oncology consultation, from 28.4 % in 1992 to 57.7% in 2002. As seen in Table 1, unadjusted rates of medical oncology consultation were higher for patients who were younger, married, had advanced-stage tumor, had a histologically confirmed adenocarcinoma, received radiation and lived in certain SEER regions (all $P < .001$). The proportion of patients who had consultation differed by stage at diagnosis: more stage IIIA patients were referred than stage II patients (51% versus 44.2%; $P < 0.001$).

Table 2 shows multivariate analysis of predictors of having a medical oncology consultation. Patients who were younger, married, had stage IIIA disease, adenocarcinoma, well-differentiated grade or received radiation were more likely to have a medical oncology consultation. In addition, the proportion of patients who had a medical oncology consultation varied by SEER area and year of diagnosis (variable not shown in table). Odds of receiving a medical oncology consultation increased by 7% per year.

Of the 3,196 eligible patients, 606 (18.96%) received adjuvant chemotherapy. As expected, receipt of chemotherapy was closely tied to seeing a medical oncologist: Among 1521 patients who saw an oncologist within four months of diagnosis, 482 (31.69%) received adjuvant chemotherapy. Among 1,675 patients who did not see an oncologist within four months of diagnosis, 124 (7.4%) received adjuvant chemotherapy.

Table 3 presents the results of a multivariable analysis of factors associated with receipt of chemotherapy. One model includes all patients, and a second model includes just those patients seen by a medical oncologist. In a multivariate analysis of chemotherapy use among all eligible patients with resected stage II, IIIA NSCLC (Table 3, Model I), patients who saw a medical oncologist within four months of diagnosis had a 3.65-fold higher chance of

receiving chemotherapy (not shown in table). Being younger, married, having advanced-stage tumor, adenocarcinoma and receiving radiation were predictors for receipt of chemotherapy. The model also shows significant geographic variation. When the multivariate analysis included only patients who had a medical oncology consultation within four months of diagnosis (Table 3, model II), variation by marital status and SEER sites mostly disappeared. Variations in chemotherapy receipt associated with age, histology type and stage were somewhat smaller in magnitude. However, variation by gender was greater.

Discussion

Our study illustrates that multidisciplinary care for lung cancer, as indicated by medical oncology consultation, was relatively uncommon in the United States in 1992. Given recent clinical trials that show a survival advantage for adjuvant chemotherapy in resected NSCLC [4, 5, 6, 7], consultation with a medical oncologist is now strongly indicated. Interventions to increase appropriate use of chemotherapy with resectable stage II–IIIA NSCLC should focus on increasing the percentage of such patients seen by medical oncologists. It is reassuring that this percentage more than doubled during the period of our study, and that the percentage of patients receiving chemotherapy also rose (Fig. 1), even before current guidelines were established.

One explanation for this dramatic increase in medical oncology consultation may have been a growing recognition of the role of medical oncologists in multidisciplinary management of resected NSCLC. Surveys in the United States showed considerable heterogeneity of belief regarding the role of chemotherapy for NSCLC among specialists [11, 12, 13], suggesting a strong need for multidisciplinary management [14, 15]. Medical oncologists not only make treatment decisions and administer chemotherapy, but also orchestrate the work of other specialists in treating lung cancer [16, 17]. A medical oncology evaluation is even more important now that clinical evidence of improved survival with adjuvant chemotherapy in resected NSCLC changes the standard of care [18]. Although the time period we studied preceded the publication of definitive clinical trials data, the increase in consultation may reflect a growing awareness in the surgical community of the role of medical management of lung cancer [19].

Younger age, being married, and higher pathological stage were associated with increased likelihood of consultation. These findings are consistent with previous studies of advanced and metastatic NSCLC [20, 21] and of other cancers [22, 23]. Lack of consensus may contribute to the geographic variation observed in this study as in others [11, 24]. Radiation therapy was associated with medical oncology consultation, suggesting that patients receiving radiation were more likely to be seen by a multidisciplinary team that included a medical oncologist.

We found evidence of variation in the use of chemotherapy by patient characteristics. However, when restricting chemotherapy analysis to patients who had medical oncology consultation within four months of diagnosis, we found that much of the variation decreased including variation by patient's age, marital status, region, tumor characteristics (stage and histology) and receipt of radiation. Our findings were encouraging, because the major

factors determining chemotherapy use among patients with medical oncology consultation were patient's medical-related factors. Decreasing variation in chemotherapy use by patient's characteristics is a plausible mechanism of reducing disparity in lung cancer treatment. The finding of lower chemotherapy use in female patients seen by medical oncologists warrants further study.

Our study has some limitations. First, decision-making on consultation is complex and involves many factors. Although we were able to create a cohort with a full range of medical and sociodemographic variables, we did not assess physician's characteristics or patient's preferences that might influence referral to a medical oncologist or receipt of chemotherapy. This study was also limited by the potential for inaccurate coding that exists with any claims-based study. Clinical information available from billing data is not as detailed as that available from chart review. We were unable to include performance status (PS), which is crucial in deciding whether a specific patient can be regarded as a good candidate for adjuvant chemotherapy. Further, we studied older patients living in regions of the country with SEER registries. Generalizability of our findings to younger patients in other areas requires further study.

Despite its limitations, our study adds to the knowledge of the impact of medical oncology consultation on the care of elderly patients with resectable NSCLC. First, the sample size of our study was large enough to allow us to draw conclusions about patterns of care in a diverse population and to examine a number of potentially confounding variables. Compared with clinical trial data [25], this population sample more closely reflects the elderly population as a whole. Since our analysis assessed practice patterns prior to publication of definitive evidence of survival benefits of adjuvant chemotherapy, the proportion of patients receiving oncology referral today may well be higher. Additional research is needed to allow a better understanding of the underlying decision for consultation in this population. Second, our findings show that disparities exist in medical oncology referral and chemotherapy use despite an encouraging referral trend. Third, seeing a medical oncologist may be a simple approach to reducing disparities in lung cancer treatment. Because almost all patients with resectable NSCLC will benefit from a medical oncologist's global evaluation, automatic referral systems should be considered to reduce variations and disparities. Both patients and clinicians need to be educated on new NSCLC management standards.

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Fig. 1.

Temporal association of rising use of adjuvant chemotherapy from 1992 through 2002 and rising trend of oncology referral

Table 1

Demographic and medical/disease characteristics of 3196 patients with resected stage II and III non-small cell lung cancer (NSCLC) according to medical oncology consultation status within 4 months of diagnosis

Characteristics	Group	<i>n</i>	%of seeing oncologist	<i>P</i> -value
Total		3196	47.6	
Age	66–69	938	52.1	<0.0001
	70–74	1148	47.4	
	75–79	787	46.6	
	80–85	323	37.5	
Gender	Male	1788	46.3	0.0879
	Female	1408	49.3	
Ethnicity	Non-Hispanic White	2763	47.8	0.2007
	Non-Hispanic Black	163	39.9	
	Hispanic	99	51.5	
	Other/Unknown	171	48.5	
AJCC stage	II	1605	44.2	0.0001
	IIIA	1591	51.0	
Grade	Well differentiated	168	52.4	0.3579
	Moderate differentiated	942	46.2	
	Poorly differentiated	1769	48.3	
	Unknown	317	45.4	
Histology type	Squamous cell carcinoma	1017	42.9	0.0012
	Adenocarcinoma	1244	51.3	
	Bronchioalveolar	200	48.0	
	Others	735	47.8	
SEER Region	San Francisco	223	29.6	<0.0001
	Connecticut	507	34.5	
	Michigan	566	51.6	
	Hawaii	86	58.1	
	Iowa	395	50.4	
	New Mexico	100	46.0	
	Seattle	360	44.2	
	Utah	55	52.7	
	Georgia	205	64.4	
	San Jose	161	36.6	
	Los Angeles	538	58.4	
Census tract education	<11%	688	48.3	0.2300
	11–18%	684	47.5	
	18–26%	669	43.9	
	> = 26%	689	44.0	
Census tract poverty level	<3.5%	721	44.4	0.2316

Characteristics	Group	<i>n</i>	%of seeing oncologist	<i>P</i> -value
Comorbidity index	3.5–6.5%	700	46.3	0.6663
	6.5–12%	660	49.1	
	> = 12%	649	44.1	
	0	2136	46.8	
	1	710	49.3	
	2	240	48.8	
Married	> = 3	110	49.1	0.0043
	No	1202	44.3	
	Yes	1994	49.5	
Metro	No	393	50.1	0.2823
	Yes	2803	47.2	
Teaching Hospital ^a	Major	1116	45.8	0.0005
	Limited/Graduate	663	45.2	
	No affiliation	1087	53.1	
Receiving radiation	Yes	1657	52.2	<0.0001
	No	1539	42.6	

^aFor 9.0% of patients, surgical procedures could not be found in inpatient claims during one month before to 4 months after lung cancer diagnosis

Table 2

Modified Poisson Regression analysis of characteristics associated with medical oncology consultation in patients with resected stage II–IIIA NSCLC within four months of diagnosis

Characteristics	Group	OR ^a	(95% CI)
Age	Every 5 years	0.92	(0.88–0.95)
Gender	Male	1.00	
	Female	1.04	(0.97–1.12)
Ethnicity	Non-Hispanic White	1.00	
	Non-Hispanic Black	0.82	(0.67–1.01)
	Hispanic	0.98	(0.80–1.20)
	Other/Unknown	0.88	(0.72–1.07)
AJCC stage	II	1.00	
	IIIA	1.11	(1.03–1.19)
Grade	Well differentiated	1.00	
	Moderate differentiated	0.84	(0.72–0.98)
	Poorly differentiated	0.87	(0.75–1.01)
	Unknown	0.91	(0.76–1.09)
Histology type	Squamous cell carcinoma	1.00	
	Adenocarcinoma	1.19	(1.09–1.30)
	Bronchioalveolar	1.06	(0.90–1.24)
	Others	1.06	(0.96–1.17)
SEER Region	San Francisco	1.00	
	Connecticut	1.09	(0.87–1.38)
	Michigan	1.60	(1.29–1.98)
	Hawaii	1.93	(1.42–2.62)
	Iowa	1.64	(1.31–2.05)
	New Mexico	1.61	(1.20–2.14)
	Seattle	1.42	(1.13–1.78)
	Utah	1.52	(1.15–2.16)
	Georgia	2.00	(1.60–2.49)
	San Jose	1.15	(0.87–1.53)
	Los Angeles	1.92	(1.56–2.37)
Census tract poverty level	<3.5%	1.00	
	3.5–6.5%	1.08	(0.97–1.21)
	6.5–12%	1.08	(0.97–1.21)
	>= 12%	0.97	(0.85–1.10)
Comorbidity index	0	1.00	
	1	1.02	(0.93–1.10)
	2	1.03	(0.90–1.18)
	>= 3	1.04	(0.85–1.26)
Married	No	1.00	
	Yes	1.10	(1.02–1.19)

Characteristics	Group	OR ^a	(95% CI)
Teaching Hospital ^a	Major	1.00	
	Limited/Graduate	0.94	(0.84–1.04)
	No affiliation	1.10	(0.99–1.22)
Receiving radiation	No	1.00	
	Yes	1.27	(1.18–1.36)

^a All odds ratios are also adjusted for year of diagnosis and poverty For 9.0% of patients, surgical procedures could not be found in inpatient claims during one month before to 4 months after lung cancer diagnosis

Table 3

Modified Poisson Regression of characteristics associated with receipt of chemotherapy for all eligible patients (Model I) and for those who had an oncology consultation (Model II)

Characteristics	Group	OR (95% CI) ^a	
		Model I	Model II
Age	Every 5 years	0.74 (0.68–0.80)	0.77 (0.71–0.85)
Gender	Male	1.00	1.00
	Female	0.98 (0.85–1.14)	0.85 (0.74–0.99)
Ethnicity	Non-Hispanic White	1.00	1.00
	Non-Hispanic Black	0.91 (0.64–1.27)	0.83 (0.57–1.22)
	Hispanic	0.70 (0.44–1.12)	0.78 (0.50–1.23)
	Other/Unknown	0.78 (0.55–1.10)	0.89 (0.62–1.28)
AJCC stage	II	1.00	1.00
	IIIA	1.54 (1.32–1.79)	1.34 (1.15–1.58)
Grade	Well differentiated	1.00	1.00
	Moderate differentiated	0.83 (0.60–1.15)	0.89 (0.64–1.25)
	Poorly differentiated	0.82 (0.60–1.14)	0.82 (0.60–1.13)
	Unknown	0.97 (0.67–1.40)	0.94 (0.66–1.35)
Histology type	Squamous cell carcinoma	1.00	1.00
	Adenocarcinoma	1.39 (1.17–1.66)	1.24 (1.03–1.48)
	Bronchioalveolar	0.99 (0.69–1.41)	0.88 (0.61–1.28)
	Others	1.30 (1.06–1.59)	1.27 (1.04–1.55)
SEER Region	San Francisco	1.00	1.00
	Connecticut	1.14 (0.78–1.67)	0.94 (0.62–1.42)
	Michigan	1.63 (1.14–2.34)	1.00 (0.68–1.47)
	Hawaii	1.10 (0.58–2.07)	0.70 (0.35–1.38)
	Iowa	1.14 (0.76–1.69)	0.84 (0.56–1.27)
	New Mexico	1.02 (0.59–1.78)	0.85 (0.49–1.63)
	Seattle	1.50 (1.02–2.21)	1.33 (0.77–1.47)
	Utah	0.78 (0.37–1.66)	0.62 (0.90–1.96)
	Georgia	1.64 (1.11–2.43)	1.09 (0.73–1.64)
	San Jose	1.66 (1.06–2.59)	1.16 (0.70–1.92)
	Los Angeles	1.55 (1.07–2.24)	1.09 (0.74–1.60)
Comorbidity index	0	1.00	1.00
	1	0.89 (0.75–1.06)	0.93 (0.78–1.11)
	2	0.83 (0.62–1.11)	0.78 (0.58–1.05)
	> = 3	0.90 (0.59–1.38)	0.88 (0.56–1.40)
Married	No	1.00	1.00
	Yes	1.23 (1.05–1.43)	1.05 (0.90–1.23)
Teaching hospital ^a	Major	1.00	1.00
	Limited/Graduate	1.03 (0.82–1.29)	1.14 (0.90–1.44)

Characteristics	Group	OR (95% CI) ^a	
		Model I	Model II
	No affiliation	1.16 (0.94–1.43)	1.19 (0.95–1.48)
Receiving radiation	No	1.00	1.00
	Yes	1.91 (1.63–2.25)	1.74 (1.47–2.06)

^a All odds ratios are also adjusted for year of diagnosis and poverty For 9.0% of patients, surgical procedures could not be found in inpatient claims during one month before to 4 months after lung cancer diagnosis