

Hospitalizations subsequent to the diagnosis of lung cancer: a clinical and financial analysis

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In patients with lung cancer, the frequency of and reasons for hospitalization following diagnosis have not been adequately evaluated. Therefore, we assessed the clinical and financial aspects of hospital admissions in this group of patients. All patients diagnosed with lung cancer at a community hospital over a 12-month period were retrospectively reviewed for hospitalizations during the subsequent 18 months. Data were collected on demographics, reasons for hospitalization, inpatient costs, and variance in utilization of inpatient services among oncologists. Of 93 patients with a new diagnosis of lung cancer in 2002, 63 were admitted a total of 128 times over the subsequent 18 months. Admissions for treatment-related toxicity were unusual (14% of total), with the majority of hospitalizations attributable to cancer complications/progression (49%) and exacerbation of comorbid conditions (29%). A total of \$4,831,853 in charges was associated with these hospitalizations, with room fees and pharmacy charges representing the two largest cost categories. Analysis of oncologists' utilization of inpatient services showed a dramatic variation. Our study concluded that although hospitalizations were common over the course of these patients' illness, treatment-related hospitalizations are far less frequent than those attributable to disease complications/progression and comorbid conditions, and the financial ramifications of these hospitalizations are substantial.

Lung cancer continues to inflict an enormous personal and financial toll upon adults in the United States as well as worldwide. During 2004, 160,000 deaths from lung cancer occurred in the United States, and the estimated national direct cost has been placed at \$4.68 billion.^{1,2}

Previous studies have shown that the major component of costs associated with this cancer is inpatient admissions.^{3,4} However, the details of these events have not been fully characterized. Most pub-

lished reports of phase III clinical trials in these patients either report only hospitalizations during the study period⁵⁻⁸ or make no comment on inpatient admissions.⁹⁻¹³

In this study, we analyzed the clinical and financial data associated with hospitalizations of all patients diagnosed with lung cancer in a community hospital setting in 2002. This analysis was possible because of our geographic setting, in which all patients are admitted to a single hospital and all oncologists admit only to this hospital, allowing us to capture detailed, complete data.

Patients and methods

We retrospectively analyzed inpatient hospitalizations for all patients diagnosed with lung cancer at the Cancer Center Community Hospital of the Monterey Peninsula, California, during 2002, with follow-up extending through June 2004. This

Manuscript received October 28, 2005; accepted January 4, 2006.

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Commun Oncol 2006;3:200-204 © 2006 Elsevier Inc. All rights reserved.

KEY POINTS

Most phase III clinical trials in lung cancer provide little information regarding hospitalizations, even though repeated admissions are frequent in patients throughout the course of their illness.

The full spectrum of hospitalizations associated with lung cancer must be included in any economic analysis of the financial impact of this disease and its treatment.

In patients with lung cancer, treatment-related hospitalizations are less common than those attributable to the complications/progression of disease and comorbid conditions.

hospital is the only inpatient facility serving our immediate area, with a population of approximately 135,000. In addition, physicians practice only at this single facility, thus allowing detailed and complete capture of the clinical course of these patients. Medical records were reviewed and financial data extracted from hospital financial records. In analyzing admissions by attending oncologists, patients were assigned to the primary oncologist, even if a covering physician had admitted them.

Results

Clinical analysis

In 2002, 93 patients were diagnosed with lung cancer (Table 1). The

majority of patients (62%) were older than age 70 (average age, 71.5 years), and 63% presented with stage IV disease. Sixty eight percent of patients were hospitalized during the period of evaluation. At the completion of the study period, only 23% were alive and 2% were lost to follow-up.

Reasons for hospitalization were divided into four categories (Table 2). The 63 hospitalized patients had a total of 128 inpatient admissions, with the most common reason being the complications/progression of lung cancer. Hospitalizations for treatment-related toxicity were uncommon (14%), and comorbid conditions represented an important cause of hospitalization in this patient group. The vast majority of these admissions

were precipitated by exacerbation of underlying cardiac or pulmonary disease (data not shown). Of the 10 cases admitted for surgical reasons, 9 were the result of thoracotomy for definitive resection and 1 was for placement of a feeding gastrostomy tube in a patient with stage IV disease. Of the 128 admissions, 39 (30%) ended with inpatient death and 28 (22%) resulted in transfer to inpatient hospice.

Evaluation of admissions by the attending medical oncologist revealed substantial variations in both the frequency of admission and the length of stay (Table 3) as well as expenses (Table 4).

Financial analysis

With total hospital expenses for these admissions at \$4,831,853, room charges (combining oncology and general medical units) represent the major contributor to charges, followed by pharmacy and laboratory testing (Table 5). All chemotherapy drugs combined contributed only \$26,147 to inpatient pharmacy costs.

Discussion

Clinical impact

Our study presents a detailed analysis of inpatient activity in patients with a diagnosis of lung cancer. Through the course of their illness, most patients required hospitalization, and repeated admissions were common.

A thorough review of outcomes research in lung cancer was published in 2004, and several conclusions are particularly pertinent to the present study.¹⁴ In most economic analyses, hospitalization is the most significant factor. Hence, a clear picture of all inpatient admissions throughout the course of this illness is essential in understanding the overall financial impact. Also, most studies in this patient population lack assessment of patient comorbidity, an important omission given the frequency with which these conditions precipitate inpatient ad-

TABLE 1
Demographics of cohort with lung cancer

	All patients (%) n = 93 (100%)	Hospitalized patients (%) n = 63 (68%)	Nonhospitalized patients (%) n = 30 (32%)
Age			
40-50	7 (7%)	3 (5%)	4 (13%)
51-60	10 (11%)	5 (8%)	5 (17%)
61-70	19 (20%)	16 (25%)	3 (10%)
71-80	35 (38%)	25 (40%)	10 (33%)
81-90	21 (23%)	13 (21%)	8 (27%)
>91	1 (1%)	1 (1%)	0
Sex			
Male	39 (42%)	27 (43%)	12 (40%)
Female	54 (58%)	36 (57%)	18 (60%)
Disease stage			
I	13 (14%)	7 (11%)	6 (20%)
II	9 (10%)	5 (8%)	4 (14%)
III	11 (12%)	8 (13%)	3 (10%)
IV	59 (63%)	43 (68%)	16 (53%)
Unknown	1 (1%)	0	1 (3%)
Ethnicity			
White	71 (76%)	47 (74%)	24 (80%)
Black	6 (6%)	6 (10%)	0
Asian	9 (10%)	7 (12%)	2 (7%)
Latino	7 (8%)	3 (4%)	4 (13%)
Histology			
Small cell	8 (9%)	5 (8%)	3 (10%)
Non-small cell	85 (91%)	58 (92%)	27 (90%)

TABLE 2

Reasons for hospitalization

	Secondary to cancer complications/progression n = 63 (49%)	Secondary to treatment toxicity n = 18 (14%)	Cancer surgery n = 10 (8%)	Comorbid condition n = 37 (29%)
Age				
40–50	2 (3%)	2 (11%)	1 (10%)	2 (6%)
51–60	10 (16%)	0	0	2 (6%)
61–70	16 (25%)	7 (39%)	3 (30%)	10 (27%)
71–80	24 (38%)	7 (39%)	5 (50%)	16 (43%)
81–90	11 (18%)	2 (11%)	1 (10%)	6 (16%)
>91	0	0	0	1 (2%)
Disease stage				
I	4 (6%)	1 (6%)	4 (40%)	2 (5%)
II	3 (5%)	1 (6%)	3 (30%)	0
III	12 (19%)	7 (38%)	2 (20%)	11 (30%)
IV	44 (70%)	9 (50%)	1 (10%)	24 (65%)

TABLE 3

Evaluation of admissions with a medical oncologist as the admitting physician

Physician	Consultations seen n = 78 (%)	Number of patients admitted n = 63 (%)	Number of admissions n = 98 (%)	Hospital days n = 610 (%)	Average days per admission
A	17 (22%)	11 (18%)	16 (16%)	100 (16%)	6.2
B	28 (36%)	16 (26%)	27 (28%)	173 (28%)	6.4
C	2 (2%)	2 (3%)	7 (7%)	27 (5%)	3.8
D	19 (25%)	11 (17%)	31 (32%)	229 (38%)	7.4
E	12 (15%)	9 (14%)	17 (17%)	81 (13%)	4.8
No medical oncologist		14 (22%)			

TABLE 4

Evaluation of hospital expenses by medical oncologist

Physician	Average charge per admission (\$17,883)	Average charge per hospital day (\$3,815)	Total charges (average, \$431,151)	Average charge per patient course* (\$52,551)
A	\$8,645	\$1,383	\$138,315	\$12,574
B	\$14,404	\$2,240	\$388,911	\$24,307
C	\$24,863	\$6,446	\$174,045	\$87,022
D	\$36,181	\$4,898	\$1,121,613	\$101,965
E	\$19,580	\$4,109	\$332,871	\$36,889

* Total charges divided by number of patients admitted

missions, as shown by our data.

Although most phase III studies report treatment-related toxicity, utilizing scales such as the National

Cancer Institute–Common Toxicity Criteria and the World Health Organization Criteria, these toxicity grades do not explicitly state whether the pa-

tient required hospitalization. A substantial number of phase III clinical trials in lung cancer make no comment on hospitalizations.^{9–13} Recently, guidelines for chemotherapeutic management of patients with stage IV non-small cell lung cancer published by the American College of Chest Physicians reviewed treatment-related toxicity, but again there were no comments on inpatient hospitalizations.¹⁶

One important economic analysis performed in conjunction with a phase III South West Oncology Group study assessed post-treatment costs and hospitalizations.¹⁷ During chemotherapy delivery, patients averaged .34 and .72 inpatient days in the two treatment arms. Following protocol treatment completion, patients then spent 21 and 22 days in the hospital, respectively. However, the reasons for these admissions and subsequent clinical course were not stated. Therefore, although dozens of randomized clinical trials have evaluated health-related quality of life in patients with lung cancer, this important issue of hospitalization has received little attention in the literature.^{15,18,19}

There is legitimate concern regarding treatment-related toxicity in this elderly population.²⁰ Yet this study shows hospitalization for side effects accounts for only one in five admissions during the course of lung cancer. Current studies of lung cancer management need to include this important variable of admissions precipitated by comorbid conditions as part of their data collection. These data are particularly important, given that patients with lung cancer have the highest rate of comorbidities found among all tumors.²¹ The serious condition of these patients was reflected in the 30% of hospitalizations ending in death and 22% resulting in transfer to inpatient hospice.

Financial impact

The economic aspects of lung cancer have been evaluated by an array of methodologies.^{22,23} Using data from

the Surveillance, Epidemiology, and End Results (SEER) cancer registry linked to Medicare claims, one financial analysis assessed the cost of lifetime care in elderly patients with advanced lung cancer.²⁴ However, the primary focus was on the cost of cancer treatment, and the contribution of inpatient hospitalization to lifetime costs was not specifically assessed.

Another study, looking at a range of cancer types including lung cancer, derived cost estimates using administrative databases.²⁵ Inpatient services accounted for the largest component (15%) of direct medical costs.

By focusing on a single institution, we were able to create a detailed financial picture of hospitalization charges, and these data make several important points. The fact that overall hospitalization charges totaled just under \$5 million for this relatively small cohort of patients underscores the significant financial impact of this aspect of lung cancer. This finding translates to \$51,955 per study patient and \$76,696 per hospitalized patient. Also, this study identifies room charges as the largest contributor to costs, followed by pharmacy. As previously mentioned, it is interesting to note that the cost of all chemotherapy drugs combined, administered during these hospitalizations, was only \$26,147, reflecting the dramatic transition to outpatient treatment of these patients.

The prominent variation in the utilization of hospital services, length of admissions, and associated charges among oncologists is striking, with an almost 10-fold difference in total hospital charges noted. The reasons for this wide variation in inpatient activity, which has been noted in a range of cancer care services,²⁶⁻²⁸ were not discernible from our data, although this was not due to the patient caseload of the individual oncologist. The extent to which factors such as severity of case mix and individual practice style (eg, utilization of home-based services to facilitate early discharge) is an

important area for further research.

To what extent can these data be extrapolated to the broader national lung cancer experience? We know that community comprehensive cancer centers such as ours report the highest percentage of lung cancer cases to the National Cancer Data Bank (NCDB).²⁹ In addition, those hospitals with total cancer caseloads of between 500 and 999 report the highest number of patients with lung cancer to the NCDB.²⁹ Therefore, we believe that our clinical setting is representative of a large portion of hospitals caring for these patients. From a financial perspective, our mean charges per hospitalization (\$17,883) are virtually identical to those for all hospital discharges in 2002 (\$17,260), according to data collected by the Agency for Healthcare Research and Quality.³⁰

Implications

What are the implications of this study for future practice and research? When assessing the financial impact of this illness and its treatment, economic analysts as well as investigators performing phase III therapeutic trials need to include the full spectrum of hospitalizations associated with lung cancer, particularly as newer targeted therapies are incorporated into our therapeutic armamentarium. Our results emphasize that to reduce inpatient admissions, there is a need for close collaboration between cancer specialists and our colleagues responsible for managing the range of comorbid conditions frequently found in these patients. This study also highlights the urgency to assess reasons for this wide range of utilization of hospital resources among oncologists.

Admittedly, there are several shortcomings to this study. It does represent a complete regional experience, but the overall number of patients is small. The applicability of our data to other clinical settings is uncertain, al-

TABLE 5

Major contributors to inpatient charges

Type of charge	Charges (%)	
Pharmacy	\$1,108,904	(23%)
Oncology unit (room)	\$929,335	(19%)
Laboratory tests	\$574,295	(12%)
Inpatient surgical services	\$350,924	(7%)
General medical unit (room)	\$333,800	(7%)
Other charges	\$1,534,585	(32%)
Total	\$4,831,853	(100%)

though, as we mentioned, these data from the community hospital experience appear to represent the most common setting for treatment of these patients in the United States. Although 86% of hospitalizations occurred in patients with stage III and IV disease, eight of these patients remain alive, and any hospitalization subsequent to completion of this study is not included in this analysis, resulting in a slight underestimation in our cost assessment.

Furthermore, our financial analysis is limited by just measuring hospital expenses. With a variety of models and measurement tools, the measurement of economic outcomes of cancer is complex. A more sophisticated evaluation of the range of hospitalizations demonstrated in this study is important to understand more fully the broader financial implications of this aspect of care.

Conclusion

This study provides a more detailed picture than has been previously reported of hospitalizations in patients with lung cancer. By presenting a broader, more longitudinal evaluation of the frequency of and reasons for hospitalizations in these patients, we go beyond the toxicity data presented in most phase III trials. This information is essential in the evaluation of the impact of newer therapies on the limited survival of this large portion of patients with lung cancer for whom cure is not yet possible.

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Conflicts of interest: None disclosed.