Costs of Posttreatment Surveillance for Patients With Upper Aerodigestive Tract Cancer

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Objectives: To determine the range of recommended follow-up strategies for patients with upper aerodigestive tract cancer treated with curative intent and to estimate the cost of follow-up.

Design: Economic analyses of the costs associated with 31 follow-up strategies (12 generic and 19 site specific) identified from a MEDLINE search of the literature for 1978 to 1997 and a search of major textbooks. Generic strategies are not specific for site or histology and are exclusive of strategies designed for the rare patient, ie, patients who would not be considered average in terms of clinical characteristics. Charge data obtained from the Part B Medicare Annual Data File and the Hospital Outpatient Bill File were used as a proxy for cost.

Setting: Ambulatory care.

Main Outcome Measures: Nationwide Medicare-allowed charges and an actual-charge proxy for 5 years of surveillance after treatment for upper aerodigestive tract cancer.

Results: Medicare-allowed charges for 5-year follow-up ranged from a low of $739 to a high of $14,079 for the generic and site-specific strategies combined and from $739 to $4,646 for the 12 generic strategies alone. When Medicare-allowed charges were converted to a proxy for actual charges using a conversion ratio of 1.62, the range was $1,198 to $22,807 for all strategies combined (a 19-fold difference in charges) and $1,198 to $7,597 for the generic strategies alone (a 5-fold difference in charges).

Conclusions: Charges vary extensively across surveillance strategies, particularly if site-specific strategies are considered, although the potential benefit of more intensive, higher-cost strategies on survival or quality of life has yet to be demonstrated.


The basic tenets of follow-up for patients with cancer are taken for granted, although there is little evidence supporting much of the current practice. Even less analysis has been conducted of the costs associated with follow-up of such patients after treatment.1-3 If these facts are considered in conjunction with the 54.2% increase in new cases of cancer in the United States during the last 45 years and the more than 50% 5-year relative survival rates for many cancers, the need for evidence-based guidelines in the follow-up of patients with cancer becomes more apparent.4 In the absence of widely accepted guidelines, it is easy to envision how substantial variation in follow-up practices could result in unrestrained costs that might continue unnoticed because of the historical lack of interest in this research area.

Among the estimated 60,000 new cases of primary upper aerodigestive tract (UADT) cancer that were projected to be diagnosed in the United States in 1997, 57,000 patients (95%) will be treated with surgery, radiation therapy, chemotherapy, or a combination and enter follow-up programs.5-7 Approximately 33% of patients will develop recurrence within 5 years.8 Few of these recurrences are curatively treated.9 Of the same 57,000 patients, approximately 4% to 6% will develop second primary cancers each year, a risk that is relatively constant during the patient’s remaining lifespan.10,11 Approximately 50% of second primary cancers are treated with curative intent.

The array of diagnostic tests used most frequently by clinicians, in conjunction with the medical history and physical examination, to evaluate the patient with UADT cancer include chest radiography, complete blood cell count (CBC), measurement of serum electrolyte and serum calcium levels, liver function tests this article is also available on our Web site: www.ama-assn.org/oto.
METHODS

FOLLOW-UP STRATEGIES

A MEDLINE search of the literature for 1978 to 1997 was performed to identify specific surveillance strategies for patients undergoing curative treatment for primary UADT carcinomas. In addition, major textbooks in the fields of otolaryngology and head and neck cancer were reviewed. Twenty-two articles or book chapters depicting 31 specific follow-up strategies for patients with UADT cancer were identified (Table). Articles were grouped into 2 categories: generic (n = 12) and site-specific (n = 19) UADT cancer surveillance strategies. Generic strategies are those that are not specific for site or specific histology, are exclusive of strategies designed for the rare patient (ie, patients who would not be considered average in terms of clinical characteristics), and thus are representative of commonly prescribed strategies.

Three reports outline strategies for follow-up espoused by either medical societies or specific cancer centers. One is the handbook by Fischer39 that was sponsored by the Connecticut State Medical Society in conjunction with other agencies. The second is a compendium of clinical practice guidelines written by experts in the field selected by the Executive Committees of the American Society for Head and Neck Surgery (ASHNS) and the Society of Head and Neck Surgeons (SHNS).25 The third represents the M. D. Anderson Cancer Center approach.36 More than half of the site-specific strategies identified in the literature review were extracted from the 2 medical society sources.25,39 Although site specific, the majority of the recommendations of Fischer39 varied across a fairly narrow range with the primary variant being the necessity of barium swallow and CT of the neck. With the exception of lip, nasopharyngeal, and laryngeal cancer, on average, 23 office visits and 5 chest radiographs were recommended. With respect to the UADT surveillance recommendations of the ASHNS-SHNS Clinical Practice Guidelines Task Force,25 the frequency of office visits and chest radiographs (on average 28 and 5, respectively) varied little across sites. The greatest variation across sites was in additional diagnostic tests generally (43%, 22%, and 20%, respectively).

A fourth survey involved 105 otolaryngology teaching departments, 53 of whom responded. Since the survey’s main focus was the initial evaluation of patients with head and neck cancer, only office visit frequency was recorded (not diagnostic test frequency) for the posttreatment period and thus the study was excluded.

Only 1 posttreatment follow-up strategy was derived from textbooks in the head and neck cancer field.39 Since it was unclear for which years after treatment the recommendations were applicable, the author was contacted (J. U. Coniglio, MD, oral communication, 1997). His strategy has changed slightly since the book’s publication. For asymptomatic patients, he currently recommends office visits and CBCs monthly in year 1, every other month in year 2, quarterly in year 3, and semiannually in years 4 and 5 after treatment. Chest radiography is recommended annually to screen for metastatic disease. Computed tomographic scanning of the chest was originally recommended annually, but is now conducted in years 3 to 5 only.

Six strategies were extracted from 2 textbooks3,9,37 devoted exclusively to the follow-up of patients with cancer. In the first text we identified, Byers37 recommends frequent follow-up during the first 2 years after treatment to detect recurrences and lifetime follow-up to detect second primary cancers. Since the published chapter delineated

*References 8-17, 19, 20, 25, 33-40.

Continued on next page
a 2-year follow-up regimen only, the author was contacted (R. M. Byers, MD, oral communication, 1997). His strategy has changed slightly. For asymptomatic patients, he currently recommends an office visit at 1 and 3 months, then office visit, CBC, and chest radiography every 6 months in year 1, and annually in years 2 to 5. He no longer recommends CBC at 3 months for asymptomatic patients.

In a more recent textbook,9 12-14 the follow-up strategies of 5 major cancer centers throughout the world are presented: Memorial Sloan-Kettering Cancer Center in New York, NY, Roswell Park Cancer Institute, in Buffalo, NY, University of Washington Medical Center in Seattle, Wash, National Kyushu Cancer Center in Fukuoka, Japan, and Royal Liverpool University Hospital in Liverpool, England. Interestingly, physicians at Memorial Sloan-Kettering Cancer Center9 and Roswell Park Cancer Institute12 follow the same general strategy for patients with UADT cancer as well as the same strategy for patients at risk for hypothyroidism. The least intensive strategy, office visits only, is pursued by physicians at the University of Washington Medical Center.11 while the most intensive strategies are those of facilities in England11 and Japan.12

One strategy is derived from 2 cohort studies13-15 conducted by the same primary author comparing routine follow-up with self-referral using a single patient cohort as its own control. Respectively, 157 and 661 patients curatively treated for squamous cell carcinoma of the head and neck who were free of disease at the first follow-up visit were followed for a minimum of 2 years. Results of the earlier study suggested that follow-up after 3 years was of little benefit and routine chest radiography should not be recommended. Thus, chest radiography was eliminated from the protocol for the 1992 study.6 Although a much greater percentage of recurrences was detected by the patient between visits in the 1992 study, there was no difference in detection rates for second primary cancers and an increase in both relative and absolute survival rates. Subset analysis of only those patients with squamous cell carcinomas of the oral cavity and oropharynx showed that no patients with recurrences of oropharyngeal cancer or advanced oral cancer were curatively treated.11 Thus, it was recommended that regular follow-up be omitted for patients with either oropharyngeal or advanced oral cancer. This study also showed that follow-up beyond 3 years was of little value in increasing survival time.

In a similar study16 of 426 patients curatively treated for cancer of the larynx, pharynx, and oral cavity, the minimum follow-up time was substantially longer (7 years). As in the studies by Boysen and coworkers,8,11,35 each patient served as his/her own control in the comparison of routine follow-up (office visits and chest radiography) with self-referral. Of 205 patients with relapses, 89 were curatively treated. Eight were detected by self-referral and 81 were detected at routine follow-up. Survival time after detection of relapse was significantly longer (P < .05) for patients with events detected at routine follow-up than for patients with events detected by self-referral (38 vs 32 months, respectively).

One study45 focused on the detection of nodal recurrence among 199 patients with advanced laryngeal carcinoma after treatment. A surveillance strategy consisting solely of routine office visits was used. Two studies46,47 measured the value of tumor markers in follow-up using different subgroups of patients with UADT cancer. Finally, 2 studies48,49 analyzed the value of yearly chest radiography in detection of lung cancer using different subgroups of patients with UADT cancer. A small survival benefit (4-6 months) was detected for routine chest radiography although the true benefit was actually less because of lead time bias. (Lead time bias is defined as a spurious increase in the diagnosis-to-death interval resulting from earlier detection of disease through screening with no delay in time of death.)

COST ANALYSES

Nationwide average charges for 1992 associated with each of the 31 follow-up strategies were computed for a single

(LFTs), thyroid function tests (TFTs), tumor markers, computed tomography (CT) of the head, neck, or maxillofacial area, and magnetic resonance imaging (MRI) of the head, neck, or maxillofacial area.9,12-14 Since no single modality has proved to be the magic bullet (ie, the test is simultaneously sensitive, specific, safe, inexpensive, and convenient), the use of multiple modalities is often recommended. The rationale of this approach, often unstated, is to increase the probability of detecting recurrences and second primary cancers earlier, thereby facilitating potentially curative treatment or appropriate palliation.

Among the methods available for detecting relapse of UADT cancer, the medical history and physical examination appear to be the most effective. For patients with oral cancer, the value of laboratory tests (multichannel blood tests, LFTs, and tumor markers) is questionable.16 For patients with laryngeal or hypopharyngeal cancer, a recent study17 showed that measurement of serum levels of squamous cell carcinoma antigen (SCCAg) detects recurrence approximately 3 months before other clinical evidence of relapse (sensitivity, 80.4%; specificity, 87.2%), although its effect on survival time is unclear. The results of further research will likely determine if SCCAg or any other serologic marker merits inclusion in standard follow-up practice.

Chest radiography has remained the primary diagnostic follow-up modality for patients with UADT cancer for the detection of lung metastases, although CT is more sensitive.18 According to 2 studies,19,20 the benefit of annual chest radiography after treatment may be minimal for patients with laryngeal or oral cancer. Plain films other than chest radiography are rarely used for patients with UADT cancer if CT and MRI are available.18

Although only moderately sensitive and specific, CT is considered the most accurate and cost-effective modality for evaluating potential neoplasms, is useful in staging, and is also excellent for bone imaging.18,21,22 The advantages of MRI over CT are the ability to differentiate soft tissues more easily and to define the margin of the tumor. Magnetic resonance imaging is also more sensitive than CT in detecting invasion of cartilage and in diagnosing perineural tumor.18 Because of cost constraints and limited accessibility, however, MRI is not used
patient with UADT cancer followed for 5 years and compared. Data sources were the 1992 Part B Medicare Annual Data File, and the first quarter 1992 Hospital Outpatient Bill File. Nationwide average allowed charge data for physician services were obtained from the 1992 Part B Medicare Annual Data File that contains Medicare Part B data by Current Procedural Terminology code and place of service, such as inpatient hospital, outpatient hospital, or office. With assistance from the Office of Research and Development of the Health Care Financing Administration, corresponding nationwide average facility charges were identified from the 1992 Hospital Outpatient Bill File.

For each follow-up strategy, charges were assigned to all tests required on a routine basis of asymptomatic patients. Some may question the need to include tests such as TFTs, CBCs, and electrolytes in the calculation of follow-up charges. No attempt was made to exclude such tests because the goal of the study was to estimate the total costs of follow-up, not just the cost of tests directed at recurrence detection. In addition, multiple, complex factors motivate physicians in the design of surveillance strategies. Thus, it was considered impractical to separate charges associated with tests conducted for general patient care from those conducted with the intent of detecting recurrent or new primary cancer.

Nationwide average charges per test or visit were calculated as the sum of physician charges and applicable facility charges (test-specific charge data are available on request from the primary author). A best-case scenario was assumed in calculating charges. For example, it was assumed that patients were healthy and that additional workup based on either symptoms or positive test results was not required. Furthermore, it was assumed that each patient survived for 5 years, since the purpose of the analysis was to estimate the cost of the initial 5-year follow-up period. It is true that many patients with UADT cancer do not live for 5 years after treatment, but this assumption can be easily relaxed. The result would be a table of follow-up charges for every combination of TNM stage and projected years of survival. Indirect costs, such as time lost from work, transportation charges, and child or adult care charges, were not factored into this analysis. Similarly, treatment charges for new primary UADT, lung, and esophageal cancers, recurrences of the initial primary UADT cancer, and other conditions detected during surveillance were ignored, although they may impose massive additional expenses for individual patients. Under these assumptions, the resulting cost estimates should be considered conservative and constitute baseline estimates of follow-up costs. All costs assumed away in this analysis would be considered add-ons to the estimates presented. Medicare-allowed charges were held constant at the 1992 level as charges were totaled for the 5-year period for each of the 31 strategies and compared across strategies. Total charges were converted to an actual charge proxy using a conversion ratio of 1.62, which was calculated from actual submitted charges for 1992. Variation in charges across the 31 separate follow-up strategies was then reanalyzed.

Follow-up charges were then calculated for each annual cohort of US patients diagnosed as having UADT cancer. Rough estimates of charges per detected recurrence or second primary cancer were also calculated. It was conservatively estimated that 33% of all patients with curatively treated UADT cancer would develop a recurrence during the 5-year period after treatment and that 4% of all patients would develop a second primary cancer annually. For ease of calculation, no overlap was assumed between patients who had recurrence and patients who developed a second primary cancer. Survival by year after treatment for patients with UADT cancer as a group was estimated from site-specific survival data for patients with cancer of the larynx, oral cavity, and pharynx. These data were weighted by the predicted number of new cases for 1997 for these sites, resulting in the following survival estimates by year after treatment: year 1, 82.4%; year 2, 70.0%; year 3, 63.8%; year 4, 59.9%; and year 5, 56.6%.

As frequently as CT. Positron emission tomography has been used to differentiate malignancy from normal tissue but, owing to high cost and limited availability, has not generally been recommended as a component in routine posttreatment surveillance.

Although often included in the workup of the initial primary cancer as a screening mechanism for second primary cancers, panendoscopy (triple endoscopy) is generally not recommended as a component of routine follow-up for patients with UADT cancer. These tests are unpleasant and costly to the patient and are generally reserved for the evaluation of patients with symptoms or abnormal findings. Thyroid function tests are often reserved for patients who have received radiation therapy to the neck or who have undergone thyroid lobectomy as part of their cancer therapy.

Various guidelines have been advocated for posttreatment surveillance, yet a review of several widely respected textbooks revealed little discussion of the topic. One textbook contained a short chapter. Two texts briefly mentioned the need for careful follow-up. However, little of what has been advocated is supported by objective data. It appears likely that physicians often adopt the surveillance regimen specific to either their training program or the facility where they practice. Since there are few persuasive analyses of whether follow-up benefits patients, intensive follow-up is difficult to justify, particularly from an evidence-based perspective.

Recommendations for the follow-up of patients with UADT cancer may be applicable to all UADT sites (generic) or may vary across UADT sites (site specific). Typical generic recommendations for posttreatment follow-up suggest from 8 to 27 office visits and 18 or fewer chest radiographs during the initial 5-year follow-up period. For the site-specific follow-up methodologies (eg, larynx, lip, or tongue), the range of tests used and the frequency of testing varies widely. Most surveillance strategies involve 3 or fewer types of diagnostic tests. Although prospective studies have been conducted, none used a randomized controlled trial design to compare outcomes of varying intensities of follow-up. Thus, there is

References 10, 15-17, 19, 20, 25, 39, 40.
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### UADT (site specific)

- **Larynx (supraglottic and glottic), oropharynx, hypopharynx, oral cavity, neck metastases (unknown primary)**
  - CPGTF, 1996
  - Total: 28 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5

- **Larynx, pharynx, and oral cavity**
  - de Visscher and Manni, 1994
  - Total: 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5

- **Larynx and hypopharynx**
  - Lara and Cuyas, 1995
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- **Larynx and oral cavity**
  - Engelen et al, 1992
  - Total: 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5

- **Hypopharynx or tongue**
  - Nakashima, 1997
  - Total: 40 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 10

- **Oropharynx and salivary gland**
  - Fischer, 1996
  - Total: 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5

- **Larynx**
  - Fischer, 1996
  - Total: 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5

- **Larynx (glottic)**
  - Nakashima, 1997
  - Total: 30 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 10

- **Larynx (advanced stage)**
  - Yuen et al, 1996
  - Total: 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0

- **Oral cavity**
  - Fischer, 1996
  - Total: 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8

- **Soderholm et al, 1992**
  - Nonsmokers
  - Total: 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 0

  - Smokers
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- **Lip**
  - Fischer, 1996
  - Total: 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5

  - CPGTF, 1996
  - Lower lip (TNM stages I-II)
  - Total: 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0

  - Lower lip (TNM stages III-IV)
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- **Nasopharynx**
  - Fischer, 1996
  - Total: 22 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 5

  - CPGTF, 1996
  - Total: 28 | 0 | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 5

- **Nakashima, 1996**
  - Good prognosis with CT
  - Total: 30 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 10

  - Good prognosis with MRI
  - Total: 30 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 10

  - Poor prognosis with CT
  - Total: 40 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 10

  - Poor prognosis with MRI
  - Total: 40 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 10

- **Paranasal sinus and nasal cavity**
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  - CPGTF, 1996
  - With CT
  - Total: 28 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 5

  - With MRI
  - Total: 28 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 5

  - Hypopharynx
  - Fischer, 1996
  - Total: 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5

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*CBC indicates complete blood cell count; LFTs, liver function tests; Elecs, electrolyte levels; TFTs, thyroid function tests; ESR, erythrocyte sedimentation rate; CaS, serum calcium levels; SCCAg, squamous cell carcinoma antigen; CT, computed tomography; MRI, magnetic resonance imaging; UADT, upper aerodigestive tract; and CPGTF, Clinical Practice Guidelines Task Force.

†Using 1992 charge data.

‡Medicare-allowed charges × 1.62 conversion ratio.

§Three-year follow-up study.
## and Tests

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no persuasive evidence that any regimen of scheduled follow-up detects recurrences and second primary cancers earlier, permits significantly earlier treatment of such lesions, lengthens survival time, or improves quality of life compared with a policy of no follow-up.

With disagreement over the appropriate frequency of follow-up and no solid data on which to base surveillance strategies, it is not surprising that few attempts have been made to ascertain the costs associated with the follow-up of patients with UADT cancer. In the 1 published work that addressed the topic, Virgo and Johnson calculated total charges as a proxy for costs for the surveillance strategies recommended by 5 major cancer centers worldwide. Nationwide average Medicare-allowed charges41,42 for 1992 were applied to the recommended 5-year follow-up strategies. Medicare-allowed charges ranged from $1633 for the least intensive strategy consisting of office visits only to $9070 for a relatively intensive regimen for patients with a poor prognosis, high SCCAg titer at initial treatment, and nasopharyngeal carcinoma (assuming MRI is available). This represents a 4.6-fold difference in charges between the most and least intensive follow-up strategies recommended by acknowledged experts. When Medicare-allowed charges were converted to actual charges using a conversion ratio of 1.62, which the authors calculated from actual submitted charge data for 1992, the resulting data reflected the following range of charges: $2645 for the least intensive strategy and $14,693 for the intensive strategy.

A shortcoming in most analyses of follow-up is the lack of cost or charge data. This study presents nationwide average charges associated with the follow-up of patients with UADT cancer after treatment for 31 separate strategies identified from the literature.

RESULTS

Of the 12 generic UADT cancer strategies, the one with the highest frequency of any single test was that of Jones, with 27 office visits. The most intensive 5-year strategy across the greatest number of tests was also that of Jones, which, in addition to the 27 office visits, consisted of 8 CBCs, 8 LFTs, 8 serum electrolyte level measurements, 8 TFTs, 8 erythrocyte sedimentation rate tests, 8 serum calcium level measurements, and 8 chest radiographs. The least intensive strategy was that of Byers with 8 office visits, 6 CBCs, and 6 chest radiographs.

The remaining 19 strategies were grouped into 14 categories based on tumor site and, in some cases, histology. Six of the categories contain recommendations applicable to multiple tumor sites. Eight categories pertain to single tumor sites. Few of the categories had a sufficient number of strategies to warrant separate discussion, with the exception of larynx, oral cavity, hypopharynx, and nasopharynx. For the 4 general follow-up strategies for patients with laryngeal cancer, an average of 15 office visits and 4 chest radiographs were recommended with no consensus on the need for SCCAg or barium swallow. For the 5 surveillance strategies for patients with oral cavity cancer, the frequency of chest radiography was relatively constant at 5 while the frequency of office visits varied widely from 16 to 28. There was also no consensus on the need for LFTs and S-5-nucleotidase. For the 4 follow-up strategies for patients with hypopharyngeal cancer, the average for chest radiography was once again 5, but the variation in the frequency of office visits (12-40) was almost 4-fold. Consensus was also lacking on the need for LFTs, CBC, SCCAg, and barium swallow. For the 3 surveillance strategies for patients with nasopharyngeal cancer (considering only those designed for patients with a good prognosis), the averages for office visits, LFT, chest radiography, and MRI were 27, 9, 7, and 6, respectively, although the ranges were rather large for all except MRI. The MRI site (maxillofacial or head) was also variable. In addition, there was no consensus on the need for CBC or TFTs.

The range of charges for the follow-up of patients with UADT cancer across the 12 generic strategies was moderately wide. Medicare-allowed charges for 5 years of follow-up varied from a low of $739 per patient based on a strategy consisting of 8 office visits, 6 CBCs, and 6 chest radiographs to a high of $4646 per patient based on a strategy consisting of 26 office visits, 26 CBCs, 5 chest radiographs, and 3 CT scans of the chest. When Medicare-allowed charges were converted to actual charges using a conversion factor of 1.62, the range was $1198 to $4976 per patient, a 4-fold difference. This difference among commonly prescribed strategies was not supported by any data demonstrating greater efficacy for the higher-cost strategies.

When all 31 strategies were viewed together, the range of charges for the surveillance of patients with UADT cancer after treatment was much wider. Medicare-allowed charges for 5 years of follow-up varied from a low of $379 per patient (as in the analysis of the 12 generic strategies) to a high of $14,079 per patient for a nasopharyngeal-specific strategy consisting of 22 office visits, 10 LFTs, 5 chest radiographs, and 5 MRI scans of the maxillofacial area. When Medicare-allowed charges were converted to actual charges using a conversion factor of 1.62, the range was $1198 to $40,907 per patient, a 9-fold difference. This massive difference was once again not supported by any data demonstrating greater efficacy for the higher-cost strategies.

Since the 2 most costly surveillance strategies were a minimum of $3800 to $5300 more expensive than the next highest cost strategy, from a conservative perspective these strategies might be considered outliers. Therefore, the difference in estimated costs between the lowest and highest cost strategies was recalculated excluding the works by Fischer and the Clinical Practice Guidelines Task Force. The next highest in cost were the 4 nasopharyngeal-specific strategies of Nakashima. Depending on whether the recommendations by Nakashima for patients with a poor prognosis are included or excluded, the result is a 9-fold to 12-fold difference between the least and most costly strategies. Even from a conservative perspective, the magnitude of the cost differential is large.

Not surprisingly, those strategies using frequent CT or MRI during the 5-year period are at the high end of...
the cost distribution. Those regimens that consist mainly of some combination of office visits, chest radiography, and blood tests are the least expensive. The lowest cost approaches consist of only 3 or fewer types of tests. Chest radiography and office visits were key components of the majority of the strategies analyzed.

The charge figures quoted herein can be considered conservative in today’s economy since they were derived from 1992 data. Updating these figures to 1997 levels can easily be accomplished using the medical care component of the Consumer Price Index. The medical care component increased 5.94% in 1993, 4.76% in 1994, 4.50% in 1995, and 3.50% in 1996. A 10-year (1987-1996) average increase in the medical care component of 6.41% was used as an estimated increase for 1997. The estimated range of actual charges for 1997 across the 12 generic UADT follow-up strategies was $1350 to $9741 per patient. This yields a difference of $8211 per patient between the most and least intensive follow-up strategies, compared with the original charge of $6428 (an increase of $1783 or 28% per patient for the 5-year period). Across all 31 surveillance regimens (generic and site specific), a conservative estimate of the range of actual charges for 1997 is $1350 to $29 131 per patient. This yields a difference of $27 601 per patient between the most and least intensive follow-up strategies, compared with the original $21 609 (an increase of $5992 or 28% per patient for the 5-year period).

Returning to the 1992 unadjusted data, for each annual patient cohort curatively treated for UADT cancer, total 5-year follow-up charges (using the actual charge proxy) range from $68.3 million to $1.3 billion depending on the intensity of follow-up (range, $68.3-$429 million if based only on the charge differential across the 12 generic strategies). Averaged over the approximately 26 400 recurrences and/or second primary cancers detected during the 5-year follow-up period for each annual cohort, the estimated charge per detected recurrence and/or second primary cancer ranges from $2587 for nonintensive follow-up to $49 242 for intensive follow-up.

COMMENT

Few attempts have been made to measure the costs associated with many routine medical practices, and the follow-up of patients with UADT cancer is no exception. As this analysis indicates, charges for follow-up can vary by as much as 19-fold. Even among generic strategies, the magnitude of the variance is 5-fold. Although the range of charges for the generic follow-up strategies for patients with UADT cancer is not as wide as for the site-specific regimens, variation of even this magnitude cannot easily be justified in this era of cost containment and health care reform. The problem is an especially interesting one because little is known about how outcomes vary when the follow-up strategy composition is altered, and the optimal follow-up testing interval has never been defined by well-designed trials. No one strategy has been established as more efficacious than any other in terms of survival and quality of life; however, the generic UADT cancer surveillance strategies have achieved at least some degree of consensus.

The most persuasive form of evidence would come from multisite prospective randomized controlled trials testing the benefits of the various regimens advocated. Such trials have been reported for postoperative surveillance of breast cancer. Cost analyses of postoperative UADT cancer surveillance are also lacking. Ideally, such analyses would incorporate not only the direct costs of follow-up but also the indirect costs, such as time lost from work, transportation costs, and child and adult care costs. Quality-of-life data should also be examined since data from prospective studies are limited in this field. The degree to which quality of life is affected either directly or indirectly by the intensity of the follow-up regimen is unknown.

After reviewing the literature regarding follow-up management practices for patients with a diagnosis of UADT cancer, an obvious question arises. Until randomized controlled trials are conducted, how should physicians choose among the recommended follow-up strategies in the literature in the absence of benefit data? Is there one follow-up strategy that should be applied to the majority of patients until further research can be conducted? In general, we recommend a minimalist approach. This is recommended because more intensive diagnostic testing has yet to demonstrate survival and quality-of-life benefits, although select patients might merit more intensive follow-up. At each visit, patients should be questioned about the presence of new symptoms or signs indicative of recurrence. The ordering of further tests would be based on this clinical evidence.

One limitation of our analysis is that actual patients were not followed up prospectively to estimate costs. Although several strategies included in the analysis are based on actual patient data, a large prospective study would allow one to collect data on the costs of many factors assumed away in this analysis, such as diagnosis and treatment costs for patients with symptoms or positive test results. In such a study in which patients are followed up prospectively, cost or charge data would also be discounted to allow for the time value of money (ie, $1 spent on follow-up in year 1 is not equivalent to $1 spent on follow-up in year 5).

Even the moderate charge differentials among the generic UADT surveillance strategies will be increasingly difficult to sustain in the current competitive medical practice environment in which cost containment is such a dominant force. Although the percentage of patients with UADT cancer in the United States is small, the number of patients with UADT cancer worldwide is large and, therefore, the total costs are staggering. Future research in the form of clinical trials is clearly needed to compare strategies and determine if intensive surveillance is rewarded by improved quality of life and longer survival.

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The views expressed herein are those of the authors and should not be construed as reflecting the official position of the Department of Veterans Affairs, St Louis University, or Washington University.