Original Study

Clinical Impact of Frequent Surveillance Imaging in the First Year Following Chemoradiation for Locally Advanced Non–small-cell Lung Cancer

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Abstract

The impact of frequent surveillance imaging for locally advanced non–small-cell lung cancer is poorly defined. We analyze patients imaged at least every 4 months the first year after chemoradiation and document recurrences, interventions, and false positives. We detected an asymptomatic recurrence in > 60% of patients, but only 3% underwent curative intent treatment. Further studies are needed to identify patient subsets that benefit from intensive surveillance algorithms.

Objective: Uncertainty exists regarding the optimal surveillance imaging schedule following definitive chemoradiation (CRT) for locally advanced non–small-cell lung cancer (LA-NSCLC) with regards to both frequency and modality. We sought to document the clinical impact of frequent (at least every 4 months) surveillance imaging. **Materials and Methods:** The records of all patients treated with CRT for stage IIIA/IIIB NSCLC between August 1999 and April 2014 were reviewed. Patients were included if they underwent frequent (at least every 4 months) chest computed tomography or positron emission tomography for routine surveillance following CRT for at least 1 year or until progression or death. Radiographic findings and clinical interventions within the first year were identified. **Results:** We identified 145 patients with LA-NSCLC treated with CRT, 63 with eligible imaging. Median age was 63.6 years (range, 41.0-86.9 years). Asymptomatic recurrence was radiographically detected in 38 (60.3%). Twenty-one (33.3%) initiated systemic therapy. Two (3.2%) underwent definitive-intent treatment for isolated disease, including lobectomy for a histologically distinct primary NSCLC and stereotactic radiotherapy for an isolated recurrence, both of whom subsequently progressed. Eleven patients (17.5%) received no further therapy. Five patients (7.9%) underwent additional diagnostic procedures for false-positive findings. **Conclusions:** Frequent surveillance within the first year following CRT for LA-NSCLC lung cancer detects asymptomatic recurrence in a high proportion of patients. However, definitive-intent interventions were infrequent. The predominant benefit of frequent surveillance appears to be expedient initiation of palliative systemic therapy. Evidence-based algorithms for surveillance are needed, and should account for expected patient tolerance of and willingness to undergo additional cancer-directed therapies.

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Introduction

Approximately 25% to 30% of patients with non–small-cell lung cancer (NSCLC) present with locally advanced stage IIIA/IIIB disease (LA-NSCLC).[1] Outcomes are generally poor in this population, with high rates of both local and distant failure and an overall survival of 19% to 36% at 5 years following definitive-intent therapy.[2] The majority of patients with LA-NSCLC are managed non-surgically, with concurrent chemoradiation (CRT) the standard-of-care for inoperable cases.

Despite high rates of relapse, the optimal schedule and modality for post-treatment surveillance following concurrent CRT remains poorly defined. Current National Comprehensive Cancer Network (NCCN) guidelines suggest follow-up with computed tomography (CT) of the chest every 6 to 12 months for the first 2 years, followed by annual low-dose non-contrast CT for those without evidence of clinical or radiographic disease.[3] Similar guidelines from the American Academy of Chest Physicians (AACP) recommend either

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chest x-ray or CT in combination with a history and physical exam every 6 months for 2 years following curative intent surgery for NSCLC, although the guidelines' authors acknowledge the limited data supporting this recommendation.[4] No current guidelines specifically address potential differences between postoperative and postradiotherapy patients, and the implications for surveillance. Evidence to guide surveillance strategies following CRT for LA-NSCLC is lacking, and nuances specific to the postradiation setting complicate follow-up approaches. Postradiation scarring may obscure or mimic tumor recurrence on CT,[5] and isolated locoregional failures are relatively rare[6]; hence, salvage options are frequently noncurative in intent.

The aim of this current study is to evaluate, in a single institution cohort, the ability of frequent, defined as at least every 4 months, posttreatment volumetric imaging to detect asymptomatic recurrence in patients with LA-NSCLC treated with definitive CRT, and to identify curative-intent and noncurative intent interventions resulting from frequent surveillance within the first year after treatment.

Materials and Methods

Patients and Treatment

Following Institutional Review Board approval, the records of all patients with LA-NSCLC treated with concurrent CRT for LA-NSCLC between January 1995 and June 2014 at the University of California Davis were reviewed. All patients underwent comprehensive staging prior to treatment including CT of the chest with contrast (unless medically contraindicated), positron emission tomography (PET)/CT starting in 2000, CT or magnetic resonance imaging of the brain, and physical examination. Patients were staged according to the American Joint Committee on Cancer, Seventh Edition.[7]

Surveillance Imaging

Patients eligible for this study were those followed with frequent surveillance imaging, defined as chest CT or PET/CT performed with a frequency of at least every 4 months for a minimum of 1 year or until disease progression or death if within the first year. Imaging was classified as surveillance if performed for routine disease assessment rather than in response to specific clinical symptoms. Both CT and PET/CT were included as surveillance scans, if performed for general response assessment or restaging, rather than in response to specific clinical symptoms. Only the first year following CRT was analyzed, as many patients moved to a less intensive schedule in the second year. Surveillance imaging schedule was determined at physician discretion. Multidisciplinary imaging review was frequently employed for cases with borderline findings.

Analysis

In order to identify eligible patients, the interval between completion of CRT, the first scan, and each subsequent scan was calculated for all patients. Subsequent management steps, including additional diagnostic procedures and both definitive and palliative intent cancer-directed therapies that resulted, were documented for each patient. Recurrences detected between surveillance scans (ie, detected because of clinical symptoms) were also documented. Overall survival for the population was calculated with the Kaplan-Meier method.

Table 1 Patient Characteristics

Characteristic	N (%)
Median age, y (range)	63.3 (41.0-86.9)
Gender	
Male	33 (52.4)
Female	30 (47.6)
Stage	
IIIA	42 (66.7)
IIIB	21 (33.3)
Histology	
Adenocarcinoma	27 (42.9)
Squamous cell carcinoma	16 (25.4)
Mixed or other	20 (31.7)
Median radiation dose, Gy (range)	61 (38-67)
Planning technique	
3DCRT	43 (68.3)
IMRT	20 (31.7)
Concurrent chemotherapy regimen	
Carboplatin/paclitaxel	28 (44.4)
Cisplatin/etoposide	25 (39.7)
Other	10 (15.9)

Abbreviations: 3DCRT = three-dimensional conformal radiation therapy; IMRT = intensity modulated radiation therapy.

Results

Patients

Of the 145 patients reviewed, 63 (43.4%) met the eligibility criteria for frequent surveillance imaging in the first year after treatment, including 33 men and 30 women. Among eligible patients, the median age was 63.3 years (range, 41.0-86.9 years). Forty-two (66.7%) presented with stage IIIA disease and 21 (33.3%) with stage IIIB disease. Table 1 summarizes the clinical and treatment characteristics of the patient cohort. All patients received concurrent chemotherapy with thoracic radiation, predominantly, weekly low-dose paclitaxel and carboplatin (n = 28 patients), or concurrent bolus cisplatin and etoposide given in 21-day cycles (n = 25). Two patients also received induction chemotherapy. Radiation was prescribed to a median dose of 61 Gy (range, 38-67 Gy) in 1.8 to 2.0 Gy fractions. Only 2 patients received a dose of < 59 Gy, 1 of whom truncated treatment after 38 Gy owing to a noncancer related medical emergency resulting in a lengthy hospital stay, and one of whom was treated to 54 Gy owing to unacceptably high lung doses with plans delivering higher doses to the target. Treatment technique was 3-dimensional conformal RT for 43 (68.3%) and intensity modulated radiotherapy for 20 (31.7%).

Surveillance Imaging

During the first year post-CRT, the patient cohort of 63 patients underwent a total of 233 surveillance scans: 115 CT of the chest (49.4%), 77 CT of the chest/abdomen/pelvis (33.0%), and 41 PET/CT (17.6%). The mean number of scans per patient was 3.6. Asymptomatic recurrence was detected by surveillance imaging during the first year post-CRT in 38 patients (60.3%), 8 (21.1%) by PET/CT, and 30 (78.9%) by CT.