

Results: Nine lesions were divided into 9 segments and 6 were divided into 17 segments, based on tumor volume. The median number of voxels within a segment was 68 (range, 6 to 334), yielding a median segment volume of 4.3 cm³ (range, 0.4 to 23.7). Median time interval between pre- and post-treatment PET scans was 4.1 months (range, 2.0 to 21.7). Linear regression of pre- and post-treatment mean segment SUV for each patient yielded a median r² of 0.55 (range, 0.21 to 0.90). This correlation did not vary with tumor size, pre- or post-treatment maximum SUV, or time between PET scans. The region of highest mean SUV changed after therapy in 10 out of 15 patients, migrating to an adjacent region in all such cases.

Conclusions: The spatial characteristics of NSCLC tumors on FDG-PET are fairly well-preserved after a partial response to radiotherapy. However, the location of the most active portion of a tumor often changes following treatment. It therefore may not be prudent to base "dose-painting" techniques solely on pre-treatment PET scan information.

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2584 Stereotactic Radiotherapy Reduces Treatment Cost while Improving Overall Survival and Local Control over Standard Fractionated Radiation Therapy for Medically Inoperable Non-small Cell Lung Cancer

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Purpose/Objective(s): Radiation therapy (RT) is the standard alternative curative treatment option for patients with early stage non-small cell lung cancer (NSCLC) that are medically inoperable. Recently, stereotactic body radiotherapy (SBRT) has shown substantial promise compared to historical local control rates achieved with conventionally fractionated RT (EBRT). We compare treatment outcomes and costs between SBRT and EBRT in this patient population.

Materials/Methods: Eighty-seven patients with Stage I (T1–2 N0) NSCLC were treated with either EBRT ($n = 42$) or SBRT ($n = 45$) between January 2002 and April 2008. No statistically significant differences were identified between the two groups in terms of age, clinical stage, histology, performance status, or gender. EBRT patients were treated to a median dose of 66 Gy with 3D conformal RT (3D-CRT, $n = 40$) or IMRT ($n = 2$). SBRT was delivered in 4 or 5 fractions to 48 (T1, $n = 44$) or 60 (T2, $n = 1$) Gy. The actual cost of each treatment course was calculated using 2008 Medicare APC and hospital-based physician fee screen reimbursement rates for both the technical and professional components of RT. Additional patient costs were examined to determine the benefit of reduced treatment visits for SBRT. Survival endpoints for EBRT vs. SBRT were compared.

Results: The median potential follow-up for all patients was 36.0 months. According to Medicare reimbursement, the cost for 4 or 5 SBRT fractions was \$8,679 or \$9,676. The cost for 33 fractions of EBRT was \$15,649. The cost for 33 fx of IMRT was \$18,801 vs. \$12,496 for 3D-CRT. Based on a median number of fractions for this patient population assuming Medicare, SBRT was significantly less expensive by \$5,973 (\$15,649 EBRT vs. \$9,676 SBRT, $p < 0.01$). If all patients had been treated with the RTOG standard of 3 SBRT fractions (20 Gy x 3), the cost savings with SBRT would have been \$8,557 per patient ($p < 0.001$). Survival analysis demonstrated superior 36-months overall survival (OS) using SBRT, 71% vs. 42% for EBRT ($p < 0.05$). SBRT also reduced local failure by nearly 3 times compared to EBRT (12% vs. 34%), although statistically a trend ($p = 0.10$). There were no significant differences in the rates of regional failure or distant metastases between the two groups.

Conclusions: In this study of Stage I NSCLC patients, SBRT was found to be less expensive than standard fractionated EBRT, with the cost savings highly dependent on the number of SBRT fractions and EBRT technique (3D-CRT vs. IMRT). As previously hypothesized from multiple single arm prospective studies, SBRT was also associated with superior local control and overall survival.

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2585 QRRO: Estimating National Benchmarks for Quality Indicators for Non-small Cell Lung Cancer (NSCLC)

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Purpose/Objective(s): To demonstrate the feasibility of measuring quality indicators (QIs) in radiation oncology (rad onc) for NSCLC from the Quality Research in Radiation Oncology (QRRO) national patterns of care database with the objective of estimating national benchmarks.

Materials/Methods: The QRRO survey database is a valuable resource for estimating national benchmarks of established and emerging QIs. The study design is a two-stage stratified sample of rad onc practices. Few surveys have documented the practice of oncology in such detail that fine adjustments can be made to account for conditions that might influence treatment decisions. For example, the National Comprehensive Cancer Network (NCCN) guidelines for Stage III NSCLC recommend a radiation therapy (RT) daily total dose of up to 74 Gy in a concurrent chemoradiation setting. However, some conditions will mediate total dose delivered e.g., if RT is stopped early due to complications, non-compliance or death, or if treatment includes surgery or for an IRB-approved protocol. Data from the 1999 survey of NSCLC were used to demonstrate that adjustments at this level of detail can be made. We also evaluated an emerging QI derived from NCCN regarding the roles of PET (or bone) scan and brain CT/MRI in the recommend evaluation of patients receiving combined modality therapy for Stage III NSCLC.

Results: Data for NSCLC patients with no distant metastases or pleural effusion treated in 1998–1999 were analyzed. Of the 180 patients with Stage III NSCLC, 132 patients received concurrent chemoradiation, of which 57 patients were excluded for conditions that might mitigate total dose as described above. Analysis showed that 87% of the patients received a total dose in the recommended range, of 59–74 Gy (median dose of 63 Gy). Of note, recommended brain MRI/CT and PET or Bone scans were performed in only 42% of the patients.

Conclusions: We demonstrated that QIs can be estimated from the QRRO survey database. While the vast majority of patients received the recommended dose of RT with concurrent chemo, the recommended staging was only performed in 42% of Stage

III NSCLC patients, suggesting a need for further improvement and education. Sub-group analyses can be performed if estimates of QIs are expected to vary *e.g.*, university facilities vs. private practices. The 2007 survey (in progress) is explicitly designed to further evaluate the quality of care. It will also permit the assessment emerging QIs such as CT-based simulation and documented DVH constraints. We expect to validate current and emerging QIs for rad onc in the current survey.

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2586 Comparison of Outcomes in Patients with Stage III vs. Oligometastatic Stage IV Non-small Cell Lung Cancer

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Purpose/Objective(s): Typically, patients with metastatic non small cell lung cancer (NSCLC) receive palliative treatment with systemic chemotherapy and/or radiation therapy. Recent studies suggest that patients with oligometastases who receive curative intent stereotactic body radiation therapy (SBRT) have encouraging survival. We hypothesized that patients treated with curative intent radiation for Stage III NSCLC have worse outcome as compared to those who receive SBRT for Stage IV oligometastases.

Materials/Methods: We retrospectively reviewed the records of patients with NSCLC treated in the Department of Radiation Oncology at the University of Rochester from 2000–2008. We identified patients treated with curative intent for initial Stage III NSCLC, oligometastatic Stage IV NSCLC at diagnosis, Stage I/II or III NSCLC who later developed oligometastases. Patients with new solitary lesions, questionable for 2nd primary Stage I NSCLC versus solitary metastasis, were excluded. The primary endpoint was 2-year overall survival (OS) for these groups. OS was calculated from both the date of initial diagnosis and date of distant/thoracic oligometastatic failure to date of last follow-up or death.

Results: Of 140 patients, 93% had KPS \geq 80%, 34% had any weight loss at diagnosis, and 96% were smokers. Median age was 66, with 73 males and 67 females. 69% received chemotherapy; 15% underwent resection of the primary lung mass as a component of their cancer treatment. The 2-year OS for all patients was 47% and 31%, when calculated from the date of diagnosis and date of first oligometastatic disease, respectively. 24% had Stage III disease that did not develop oligometastases; their 2-year OS was 60%. 28% of patients had oligometastatic Stage IV disease; this group had a 2-year OS of 50%. Stage III patients who developed oligometastases comprised 38%, with a 2-year OS of 13% when calculated from date of first metastases and 34% from initial date of diagnosis. 5% had Stage I/II disease that progressed to oligometastases, with a 2-year OS of 80% calculated from time of diagnosis and 25% from time of metastases.

Conclusions: Patients with oligometastatic Stage IV NSCLC fared better than those with Stage III NSCLC. Our results suggest that AJCC Stage IV NSCLC is a heterogeneous patient population, with a selected cohort of patients faring significantly better than Stage III disease. Though patients with oligometastases are favorably selected by virtue of more indolent disease and/or less bulky disease burden, perhaps staging these patients differently is appropriate, as AJCC staging is intended to stratify patients into prognostic and treatment groups. Aggressive local therapy is arguably indicated in these patients as a curative intent therapy.

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2587 Pilot Study of EGFR-TKIs in Combination with Radiation for Patients with Locally Advanced and Metastatic Non-small Cell Lung Cancer

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Purpose/Objective(s): To establish the safety and toxicity profile of daily epidermal growth factor receptor tyrosine kinase inhibitors (gefitinib or erlotinib) with radiation alone in patients with locally advanced and metastatic non-small cell lung (NSCLC).

Materials/Methods: Patients with locally advanced and metastatic NSCLC were treated with concomitant modern radiotherapy (three-dimensional conformal radiotherapy, stereotactic body radiotherapy) alone with of daily EGFR-TKI (gefitinib 250 mg) or (erlotinib 150 mg). Once a safety profile was determined, patients were then treated with daily EGFR-TKIs up to occurrence of tumor progression or intolerable toxicity.

Results: Twenty patients were enrolled and assessable for toxicity and 19 patients were available for progression-free survival (PFS) and time to progression (TTP). The median age was 56 years (range, 30–84); the ratio of male and female was 1:1; the median score of Eastern Cooperative Oncology performance status was 1 (range, 0–2). Histological types included 11 adenocarcinomas, 6 squamous cell carcinoma, and 3 mixed type; 13 patients were Stage IV and 7 patients for Stage IIIB. With the median follow-up of 6.4 months (range, 2.1–22.2 months), the median PFS and TTP were 5.0 months and 4.6 months, respectively. The median survival time was 11.8 months and 1-year overall survival was about 50%. The most common toxic side effects (\geq 20%) included acne-like skin rashes (70%) with the median occurrence of Day 7, fatigue (55%), anorexia (50%) and nausea (40%), pruritus (35%), mucositis (30%) and diarrhea (25%). One patient experienced Grade 4 neutropenia and thrombocytopenia, who received chemotherapy of gemcitabine plus cisplatin four weeks before. Acute radiation morbidity mainly included Grade 1/2 esophagitis (15%, 3/20) and Grade 1/2 pneumonitis (15%, 3/20). Three patients suffered from Grade 1/2 pulmonary fibrosis (15%, 3/20) in late radiation morbidity. There was no Grade 3/4 acute and late radiation toxicity. There was no treatment-related death.

Conclusions: EGFR-TKIs with concomitant RT was well-tolerated and could serve as a therapeutic option for patients with locally advanced and metastatic NSCLC.

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