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Research Article

Evaluation of changes in tumor volume following upfront chemotherapy for locally advanced Non Small Cell Lung Cancer (NSCLC)

Omer Sager*, Ferrat Dincoglan, Selcuk Demiral and Murat Beyzadeoglu

Department of Radiation Oncology, University of Health Sciences, Gulhane Medical Faculty, Ankara, Turkey

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***Corresponding author:** Dr. Omer Sager, Department of Radiation Oncology, University of Health Sciences, Gulhane Medical Faculty, Ankara, Turkey, Tel: +90 312 304 4683; Fax: +90 312 304 4680;
E-mail: omersager@gmail.com

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Abstract

Objective: In the setting of upfront chemotherapy, some degree of reduction in primary tumor volume may occur. This may be of critical importance in the setting of locally advanced Non Small Cell Lung Cancer (NSCLC) when upfront definitive irradiation is not feasible due to critical organ dose constraints. Selected patients with tumor volume reduction after upfront systemic therapy may be considered for curative radiation therapy (RT). To address this issue, we evaluated changes in tumor volume following upfront chemotherapy for NSCLC in this original article.

Materials and methods: Patients receiving upfront chemotherapy for locally advanced NSCLC were identified and analyzed. All patients had upfront chemotherapy and were subsequently referred for curative RT at Department of Radiation Oncology, Gulhane Medical Faculty, University of Health Sciences. Tumor size changes following upfront chemotherapy have been documented for performing the comparative evaluation.

Results: Decision making for individualized management of patients was based on thorough multidisciplinary evaluation with input from experts in pulmonology, pulmonary surgery, radiology, medical oncology, and radiation oncology. Tumor size changes were assessed in a series of patients receiving upfront chemotherapy for NSCLC. There was a mean decrease of 24% in tumor volume following upfront chemotherapy.

Conclusion: A mean decrease of 24% in tumor volume occurred following upfront chemotherapy in our study for patients with locally advanced NSCLC having extensive tumor burden. Adaptation of curative RT target volumes with respect to tumor volume reductions should be assessed in prospective randomized studies to shed light on the issue of reduced volume irradiation.

Introduction

Pulmonary cancers are among the leading causes of cancer mortality around the globe and a major public health concern worldwide as a very frequent cancer in both men and women [1,2]. Lung cancer is broadly divided into 2 subgroups including Small Cell Lung Cancer (SCLC) and Non Small Cell Lung Cancer (NSCLC) with NSCLC comprising the majority of all cases [1,2]. Although with a relatively more favorable overall prognosis compared to SCLC, NSCLC results in mortality in a significant proportion of affected patients within 5 years after diagnosis. Patients with NSCLC may suffer from a plethora of symptoms depending on lesion size, location, and disease extent. Since a considerable proportion of affected patients suffer from metastatic disease at initial diagnosis, upfront chemotherapy may be utilized to address the systemic disease burden. Also, some patients with locally advanced disease receive upfront chemotherapy. In the setting of upfront chemotherapy, some degree of reduction in primary tumor volume may occur. This may be of critical importance in the setting of locally advanced

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NSCLC when upfront definitive irradiation is not feasible due to critical organ dose constraints. Selected patients with tumor volume reduction after upfront systemic therapy may be considered for curative Radiation Therapy (RT). To address this issue, we evaluated changes in tumor volume following upfront chemotherapy for NSCLC in this original article.

Materials and methods

Fourteen patients receiving upfront platinum based chemotherapy for locally advanced NSCLC were identified and analyzed in this retrospective study. Decision making for individualized management of patients was based on thorough multidisciplinary evaluation with input from experts in pulmonology, pulmonary surgery, radiology, medical oncology, and radiation oncology. All patients included in the study had locally advanced NSCLC with TNM stages of T3-T4 and N2-N3 M0 disease. All patients had upfront chemotherapy for and were subsequently referred for curative RT at Department of Radiation Oncology, Gulhane Medical Faculty, University of Health Sciences. A comparative assessment has been performed for detecting changes in tumor size after upfront chemotherapy by considering the initial thorax Computed Tomography (CT) scans and CT-simulation images of patients. Following upfront chemotherapy, included patients underwent CT-simulation at our department at the CT-simulator (GE Lightspeed RT, GE Healthcare, Chalfont St. Giles, UK). Tumor size changes following upfront chemotherapy have been documented for performing the comparative evaluation.

Results

In this retrospective study, tumor size changes were assessed in a series of 14 patients receiving upfront chemotherapy for locally advanced NSCLC at Department of Radiation Oncology, Gulhane Medical Faculty, University of Health Sciences. Decision making for individualized management of patients was based on thorough multidisciplinary evaluation with input from experts in pulmonology, pulmonary surgery, radiology, medical oncology, and radiation oncology. Five female and 9 male patients with a median age of 68 years (range: 43-81 years) were included in this retrospective study. All patients had upfront platinum based chemotherapy regimen (cisplatin doublet). Assessment of neoadjuvant chemotherapy response was performed within 4 weeks after the last cycle, and all patients were deemed suitable for proceeding with subsequent curative intent chemoradiotherapy as planned. Tumor sizes at diagnostic CT scan of the patients and at CT-simulation for curative RT planning RTP following upfront chemotherapy were assessed comparatively. There was a mean decrease of 24% (range: 16%-33%) in tumor volume following upfront chemotherapy.

Discussion

Lung cancer is of utmost importance in terms of its relatively higher frequency and substantial impact as a leading cause of cancer related mortality in both men and women around the globe. There is extensive effort to improve outcomes of management, however, relatively small improvements are being achieved in patient survival over the years. High tumor burden at initial diagnosis is not uncommon, and some patients are considered for upfront chemotherapy to address systemic disease burden. In the setting of locally advanced NSCLC, administration of definitive RT at high doses may not be achievable due to inability to meet critical organ dose constraints. Critical organs such as the spinal cord, heart, esophagus, and the lungs may be exposed to high doses in patients with high tumor volumes, and treatment induced toxicities may preclude administration of optimal radiation doses for curative RT. In this setting, improving the toxicity profile of radiation delivery is an important issue. There has been substantial progress with contemporary RT strategies incorporating molecular imaging techniques and Magnetic Resonance Imaging (MRI), automatic segmentation methods, , Image Guided Radiation Therapy (IGRT), Intensity Modulated Radiation Therapy (IMRT), Adaptive Radiation Therapy (ART), Breathing Adapted Radiation Therapy (BART), and stereotactic irradiation as Stereotactic Radiosurgery (SRS), Hypofractionated Stereotactic Radiotherapy (HFSRT), and Stereotactic Body RT (SBRT) which may allow for improved critical organ sparing for an improved therapeutic ratio [3-63]. In the context of locally advanced NSCLC with high initial tumor burden, upfront chemotherapy utilization may offer reduction in tumor volumes and facilitate subsequent RT planning. There was a mean decrease of 24% in tumor volume following upfront chemotherapy in our study which may have implications for reduced volume irradiation for curative radiotherapeutic management of selected patients with locally advanced NSCLC. Clearly, there may be critical concerns regarding irradiation of postchemotherapy volumes and the risk of underdosing submicroscopic disease for some patients. In this context, this radiotherapeutic strategy should be thoroughly evaluated in prospective randomized studies. However, this approach may still deserve consideration at least for selected subgroups of patients particularly when the extent of tumor burden does not allow delivery of curative RT doses.

Conclusion

A mean decrease of 24% in tumor volume occurred following upfront chemotherapy in our study for patients with locally advanced NSCLC having extensive tumor burden. Adaptation of curative RT target volumes with respect to tumor volume reductions should be assessed in prospective randomized studies to shed light on the issue of reduced volume irradiation.

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