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Research Article

Tumor Size Changes After Chemotherapy for Small Cell Lung Cancer (SCLC)

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ABSTRACT

Aim and Background

Small Cell Lung Cancer (SCLC) is an aggressive subtype of lung cancer, however, response to chemotherapy and radiation therapy (RT) may be satisfactory in selected patients. Chemotherapy is a main therapeutic modality for management of SCLC which may result in significant tumor shrinkage. In this study, we evaluated tumor size changes after upfront one cycle of chemotherapy for SCLC.

Materials and Methods

Ten patients with SCLC receiving upfront one cycle of platinum-based chemotherapy were assessed for tumor size changes in this study. Tumor volumes at initial diagnostic CT scans and at CT-simulation for Radiation Treatment Planning (RTP) after one cycle of chemotherapy were comparatively analyzed.

Result

Mean tumor size at diagnostic CT scan was 132.9 cc (range: 69-228 cc). Mean tumor size at CT-simulation after one cycle of chemotherapy was 85.5 cc (range: 44-147 cc). Mean decrease in tumor size after one cycle of chemotherapy was 34.14% (range: 23.38%-50.56%).

Conclusion

Tumor shrinkage occurred in all patients after one cycle of upfront platinum-based chemotherapy in our study with a mean tumor size decrease of 34.14%. Reduction in tumor size may have therapeutic exploitations particularly in the context of reduced volume thoracic irradiation for SCLC despite the need for further supporting evidence.

Keywords: Small Cell Lung Cancer (SCLC), Chemotherapy, Radiation Therapy (RT)

INTRODUCTION

Lung cancer remains to be a public health concern as a prominent cause of deaths due to cancer [1,2]. Small Cell Lung Cancer (SCLC) is an aggressive subtype of lung cancer with short doubling time and high growth fraction. Chemotherapy and Radiation Therapy (RT) are utilized for multimodality management of SCLC, and response to treatment may be satisfactory in selected patients. Supplementing chemotherapy with incorporation of RT in management of SCLC improves local control and overall survival as supported by high level evidence [3-10]. In the context of treatment sequencing, earlier administration of thoracic RT within initial weeks of chemotherapy commencement improves therapeutic outcomes [11,12]. However, treatment induced adverse effects should be considered in multimodality management of SCLC and radiation exposure of normal tissues should be minimized to improve the therapeutic ratio. Reduced volume thoracic irradiation may be considered to improve the toxicity profile of radiation delivery in the setting of tumor shrinkage during chemotherapy. Within this context, we assessed tumor size changes after upfront one cycle of chemotherapy for SCLC and discussed its potential therapeutic exploitations in this study

MATERIALS AND METHODS

Ten patients with a histopathological diagnosis of SCLC who had available thorax CT scans as part of initial workup were

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included in the study. All patients received upfront one cycle of platinum-based chemotherapy and then were referred for RT at our institution University of Health Sciences, Gulhane Medical Faculty, Department of Radiation Oncology. For the purpose of this study, a comparative analysis was performed for tumor size at diagnostic CT scan of the patients and at CT-simulation for RTP after one cycle of platinum-based chemotherapy. CT-simulations of the patients were performed at CT-simulator (GE Lightspeed RT, GE Healthcare, Chalfont St. Giles, UK) available at our department to be used in RTP. Tumor size changes after one cycle of platinum-based chemotherapy were documented for comparative assessment.

RESULTS

Ten patients with SCLC referred to University of Health Sciences, Gulhane Medical Faculty, Department of Radiation Oncology for thoracic RT after one cycle of platinum-based chemotherapy were assessed for tumor size changes. Tumor size at diagnostic CT scan of the patients and at CT-simulation for RTP after one cycle of platinum-based chemotherapy were comparatively analyzed.

Mean tumor size at diagnostic CT scan was 132.9 cc (range: 69-228 cc). Mean tumor size at CT-simulation after one cycle of chemotherapy was 85.5 cc (range: 44-147 cc). Mean decrease in tumor size after one cycle of chemotherapy was 34.14% (range: 23.38%-50.56%). Details of comparative tumor size assessment are shown in Table 1 and Table 2.

Patient No	Tumor size at diagnostic CT scan	Tumor size at CT-simulation	Decrease in tumor size after one cycle chemotherapy
1	136 cc	95 cc	30.15%
2	69 cc	51 cc	26.09%
3	228 cc	122 cc	46.49%
4	77 cc	59 cc	23.38%
5	97 cc	73 cc	24.74%
6	89 cc	44 cc	50.56%
7	182 cc	104 cc	42.86%
8	94 cc	62 cc	34.04%
9	212 cc	147 cc	30.66%
10	145 cc	98 cc	32.41%

Table 1: Results of tumor size assessment at diagnostic CT scan and at CT-simulation.

Mean tumor size at diagnostic CT scan	Mean tumor size at CT-simulation	Mean decrease in tumor size after one cycle of chemotherapy
132.9 cc	85.5 cc	34.14%

Table 2: Mean tumor size results at diagnostic CT scan and at CT-simulation.

DISCUSSION

SCLC is characterized by short doubling time and high growth fraction which typically results in widespread dissemination with an aggressive disease course. Chemotherapy is an integral part of SCLC management. Incorporation of thoracic RT may improve treatment outcomes for SCLC, however, treatment induced toxicities may prevent delivery of optimal radiation doses. In this context, efforts have been focused on improving the toxicity profile of radiation delivery. Contemporary radiotherapeutic approaches incorporating automatic segmentation techniques, molecular imaging methods and Magnetic Resonance Imaging (MRI), Adaptive Radiation Therapy (ART), Image Guided Radiation Therapy (IGRT), Intensity Modulated Radiation Therapy (IMRT), Breathing Adapted Radiation Therapy (BART), and stereotactic irradiation with Stereotactic Radiosurgery (SRS), Fractionated Stereotactic Radiotherapy (FSRT), and Stereotactic Ablative Body Radiotherapy (SABR) may allow for optimized normal tissue sparing for an improved therapeutic ratio in the management of several tumors throughout the human body [13-65]. Although the overall prognosis of SCLC is typically poor, response to chemotherapy and RT may be satisfactory in selected patients. Within this context, studies have also addressed reduced volume thoracic irradiation which may improve the toxicity profile of radiation delivery [66-68]. In the era of contemporary technologies and modernized treatment equipment, reduced volume thoracic irradiation may provide improved normal tissue sparing which may allow for dose escalation to achieve an improved therapeutic ratio.

Preliminary results from an interim analysis of the prospective randomized noninferiority trial by Hu et al. revealed that irradiation of the postchemotherapy tumor extent and omission of elective nodal irradiation did not compromise locoregional control for patients with limited-stage SCLC [66].

A study by the Southwest Oncology Group addressed the use of wide field RT versus reduced field RT in patients with limited stage SCLC [67]. The extent of chest RT did not affect overall survival in this randomized phase III study [67].

In the study by Yee et al. investigating post-chemotherapy consolidation thoracic RT for extensive-stage SCLC, treatment was well tolerated with the maximal acute radiation induced toxicity being grade 2 esophagitis [68]. Symptomatic chest recurrences occurred in only 5 patients out of the total 32 patients [68].

Overall, irradiating a reduced RT volume in the setting of tumor shrinkage after upfront chemotherapy may be considered despite the need for further supporting evidence. In our study with ten patients, mean decrease in tumor size after one cycle of chemotherapy was 34.14% (Table 1 and Table 2) for patients with SCLC. Focusing on reduced postchemotherapy tumor volume for thoracic irradiation of patients with SCLC may be

considered to spare patients from radiation induced adverse effects such as radiation pneumonitis and esophagitis.

Clearly, we acknowledge limitations of our study including the limited number of patients. Consideration of tumor shrinkage for adaptation of RT target volumes may raise concerns for underdosing of microscopic disease in the absence of documentation for histologic tumor clearance. Irradiation of smaller tumor volumes after chemotherapy for SCLC may be an appealing treatment concept in the context of improved normal tissue sparing, however, this approach should be thoroughly assessed and validated in prospective randomized trials before routine implementation in clinical practice.

CONCLUSION

In conclusion, tumor shrinkage occurred in all patients after one cycle of upfront platinum-based chemotherapy in our study with a mean tumor size decrease of 34.14%. Reduction in tumor size may have therapeutic exploitations particularly in the context of reduced volume thoracic irradiation for SCLC, however, this approach needs validation with high level of evidence before routine clinical implementation.

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