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Ten-Year Experience in Single-Fraction Lung SBRT for Primary and Metastatic Lung Tumors

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Abstract

Objectives:

The aim of this study is to review 10 years of using single-fraction lung stereotactic body radiation therapy (SF-SBRT) and evaluate in terms of survival, local control and toxicity.

Methods:

Between 2002 and 2023, 364 patients with 412 lung tumors were treated using SBRT at our institution. Of those, 65 lesions in 57 patients were treated using a SF-SBRT 30 Gy fraction between 2013 to 2023. Factors taken into account for deciding single fraction SBRT included: periferically located lesion and less than 4 cm diameter. SBRT procedure involved: Slow-scan computed tomography (CT) simulation with immobilization devices, contouring the target volume in 3 sets of CTs, superimposing the volumes in the planning system to represent the internal target volume and dose calculation using heterogeneity correction. Radiation delivery with multiple static planar or non-coplanar beams and arc therapy assured conformal dose distribution and steep fall-off of the radiation. The prescribed dose was a single 30-Gy fraction with at least 95 % of the ITV covered by the 95% isodose line. Dosimetric constraints were set for surrounding organs at risk. Repeated cone-beam CT (2 previous and 1 after radiation administration) were used to verify and adjust daily positioning. Toxicity and radiologic response were assessed in follow-up visits, using standardized criteria (RTOG and RECIST) and analyzed retrospectively. Survival rates and toxicities were calculated by the Kaplan-Meier method.

Results:

Median patient age was 71 years (51-87). All patients had good performance status at the moment of treatment (ECOG PS 0-1). Because of patient's comorbidities or preferences, none were surgical candidates. The FEV1 was over 30 % of predicted in all cases. 60 % of all patients also received systemic treatment before or after SBRT. 89,3 % of the patients had 18- FDG PET-CT previous to SBRT. There were 23 primary tumors (T1N0M0: 7 adenocarcinoma, 4 epidermoid, 2 undifferentiated non-small cell lung cancer and 12 PET positive tumors without histology determined) and 42 oligometastases from various origins (23 colo-rectal, 16 contralateral lung non-small cell cancer, 1 thyroid, 1 renal cell, 1 sarcoma). Mean tumor volume (ITV) was 3.4 cm3 (0.6-24.3). No acute toxicities grade III or more were identified. There were 5 patients with asymptomatic radiation neumonitis. The overall median follow-up was 61 months (9 - 130). The 1, 2 and 5-year overall survival rates were 93, 73 and 54%. The 1, 2 and 5-year cancer-specific survival were: 95%, 80% and 60%. Local control in the irradiated volume is 99,3 %, with 11 distant thoracic (outside irradiated volume) recurrences.

Conclusion(s):

In selected patients with primary and metastatic lung tumors, SF-SBRT is an excellent treatment option in terms of survival, local control and toxicity. Outcomes from this analysis are comparable to published results from 2 randomized trials and validate the use of this schedule in routine practice. In the absence of phase 3 trials, this study should encourage increased use of SF-SBRT for inoperable tumors.