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Single Fraction Stereotactic Body Radiotherapy (SBRT) for Primary and Metastatic Lung Tumors

Luis Larrea [1] , Enrique López [2] , Verónica González [2] , Miguel A. Berenguer [3] , Paola Antonini [4]

1. Radiation Oncology, Hospital Virgen Del Consuelo, Valencia , ESP 2. Radiation Oncology, Hospital Virgen Del Consuelo, Valencia, ESP 3. Radiation Oncology, Hospital Virgen Del Consuelo - ICO, Valencia, ESP 4. Radiation Oncology, Hospital Virgen Del Consuelo

Corresponding author: Luis Larrea, larrea.crisol@gmail.com

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Objectives: The aim of this study is to review our experience and evaluate the results of single fraction SBRT for primary and metastatic lung tumors in terms of survival, local control and toxicity.

Methods: Between 2002 and 2018, 272 patients with 324 lung tumors were treated using SBRT at our institution. Of those, 41 lesions in 35 patients were treated using a single 30 Gy fraction. 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 69 years (51-86). 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. 63 % of all patients also received systemic treatment before or after SBRT. 943 % of the patients had 18-FDG PET-CT previous to SBRT. There were 14 primary tumors (T1N0M0: 6 adenocarcinoma, 2 epidermoid, 2 undifferentiated non small cell lung cancer and 4 PET positive tumors without histology determined) and 27 oligometastases from various origins (14 colo-rectal, 10 contralateral lung non small cell cancer, 1 thyroid, 1 renal cell, 1 sarcoma). Mean tumor volume (ITV) was 3.5 cm3 (0.6-24.3). No acute toxicities of any grade were identified. There were 3 patients with asymptomatic radiation neumonitis. The median follow-up was 19 months (5-71). The 1 and 2-year overall survival rates were 93 and 73 %. The 1 and 2-year cancer-specific survival were: 95% and 80%. Local control in the irradiated volume is 100 %, with 7 distant thoracic (outside irradiated volume) recurrences.

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Conclusions: In selected patients with primary and metastatic lung tumors, single fraction SBRT is an excellent treatment option in terms of survival, local control and toxicity. Our encouraging results are similar to those reported in ultrahypofractionated regimens also used at our institution such as 45 Gy in 3 fractions given over 7-10 days. This single fraction modality reduces the direct and indirect costs.