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Abstract

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Outcome Analysis of Lung SBRT Administered by a Single Radiation Oncologist at an Institution

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Abstract

Objectives:

To study the effectiveness of lung SBRT prescribed by a single radiation oncologist at an institution using a stereotactic frame. The unique data of our experience eliminates the variation caused by the involvement of multiple radiation oncologists and the mixture of the frame and non-frame based SBRT procedures, providing invaluable insights on the effects of patient characteristics and radiation dosages, i.e., biological effective dose (BED10), on the treatment outcome.

Methods:

One radiation oncologist specializing in lung cancers has treated over 300 patients since 2006 with SBRT in our institution. Among those, we selected 110 consecutive patients, all treated using a ten-field conformal radiotherapy technique with patients in a stereotactic body frame (custom-made or Elekta body frame). The dosing schemes varied in terms of the number of fractions (3 to 5), the dose per fraction (8 to 18Gy), and the total dose (40 to 54 Gy). The median BED10 was 141 Gy (84 to 222 Gy). GTVs were segmented using diagnostic PET data. ITVs were obtained using free-breathing CT and 4D CT images. PTV was constructed by adding a 5mm margin to ITV. The median patient age was 74 (48 to 88). There were 65 males and 45 females. There were 55 patients with T1 and 25 patients with T2 primary tumors. Thirteen were recurrent cases, and eighteen were metastatic lung cancers. The histology was 30 adenocarcinomas and 38 squamous cell carcinomas. The histology of 39 tumors was not specific. Patients were usually followed every three months with CT scans after the completion of SBRT. The median follow-up length was 642 days, with a mean of 758 days (68 to 2455 days). In addition, we collected the follow-up data of local failure (LF), distant metastasis (DM), and the date of death by the disease (DOD) or by other causes (DOO).

The survival data were analyzed using the Kaplan-Meier (KM) method. Additionally, radiomics analysis of the planning CT with ITV as a region of interest was performed. Predictive models using the random survival forest model were created to identify the significant prognostic factors among radiomics features, demographic, and dosimetric parameters. The statistical analyses were done using R and Python.

Results:

The top three most important prognostic features were wavelet-LHH_gldm_DependenceEntropy, BED10, and wavelet-LHL-first-order-skewness. The one-year local control rate was 88.3%. The overall five-year survival rate (OS5) was 23.4%. The OS5 rates of DOD and DOO were 8% and 15%. The OS5 rate of primary lung cancer patients was 28% vs. 20% of metastatic cancer patients. There was no difference in the OS5 rate between males and females. DM occurred earlier than LF. As for the radiation dose, a larger BED10 lead to a longer survival time.

Conclusion(s):

The current study showed the efficacy of lung SBRT performed by a single radiation oncologist at an institution with a uniform treatment technique over more than ten years. The statistics can be improved by adding more cases from the same database in future analyses.