Implementing the Monte Carlo algorithm in lung SBRT: clinical outcome on 205 patients

J.E. Bibault1, X. Mirabel1, T. Lacornerie1, E. Tresch1, E. Lartigau2

1Oscar Lambret Comprehensive Cancer Center, Academic Radiation Therapy Department, Lille, France
2Biostatistics Department, Lille, France

Purpose/Objective: SBRT is the standard of care for inoperable patients with early-stage lung cancer without lymph node involvement. Excellent local control rates have been reported in a large number of series. However, prescription doses and calculation algorithms vary to a great extent between studies, even if most teams prescribe on the D95 of the PTV. Type A algorithms are known to produce dosimetric discrepancies in heterogeneous tissues such as lungs. This study was performed to present a MC prescription dose for NSCLC adapted to lesion size and location and compare the clinical outcome of two cohorts of patients treated with a type A algorithm and standard prescription dose or the proposed MC protocols.

Materials and Methods: All inoperable patients treated in our institution between August 2007 and April 2013 with SBRT for early-stage lung cancer were included. Treatment planning was performed with a type A algorithm (Ray Tracing, RT) with 3 fractions of 20 Gy for peripheral lesions and 60 Gy in 5 fractions for central lesions prescribed to the PTV D95 until January 2011. A type B algorithm (Monte Carlo, MC) with 54 Gy in 3 fractions for peripheral lesions with a diameter under 30 mm, 60 Gy in 3 fractions for lesions with a diameter over 30 mm and 55 Gy in 5 fractions for central lesions was used for patients treated after this date. All treatment plans were recalculated with both algorithms for this study. Spearman’s rank correlation coefficient was calculated for GTV and PTV. Local control, overall survival and toxicity were compared between the two groups.

Results: 205 patients with 214 lesions were included in the study. 121 lesions were treated with RT and 93 with MC. D50 of the GTV calculated with MC was poorly correlated with the D95 of the PTV calculated with RT (r=0.116) for lesions with a diameter of 20 mm or less. For lesions larger than 20 mm, spearman correlation was higher (r=0.618), but still insufficient. Overall survival rates were 94% and 86% at one and two years respectively. Local control rates were 93% and 79% at one and two years respectively. There was no significant difference between the two groups for overall survival (p=0.785) or local control (p=0.934). 56 patients (27%) presented a grade 1 lung fibrosis without clinical consequences. GTV size was a prognostic factor for overall survival (HR=1.026, IC95% [1.01-1.041], p<0.001) and total dose was a prognostic factor for local control (HR=0.924, IC95% [0.870-0.982], p=0.011).

Conclusions: The dose calculated with a type A algorithm does not correctly reflect the dose actually received by the tumor. A type B algorithm should be preferred to directly prescribe on the GTV in order to avoid the dose calculation variability created by normal lung tissue found in the GTV to PTV margin. Patients treated with the proposed protocol had the same local control and overall survival rates as patients treated with the type A algorithm.

Implementing the Monte Carlo algorithm in lung SBRT: Volumetric analysis of MRI response in meningiomas treated with 3-dimensional conformal radiation therapy

C. Kim1, N. Lee1, W. Yoon1, Y. Chung1, N. Lee1

1Korea University Anam Hospital, Radiation Oncology, Seoul, Korea Republic of
2Korea University Anam Hospital, Neurosurgery, Seoul, Korea Republic of
3Korea University Anam Hospital, Radiology, Seoul, Korea Republic of

Purpose/Objective: We evaluated sequential magnetic resonance imaging to assess the inherent response of intracranial meningiomas after three-dimensional conformal radiation therapy.

Materials and Methods: Quantitative tumor volume measurements were generated from 126 magnetic resonance images of a total of 26 patients. Both parametric and nonparametric regression analyses were used to assess the relationships of the percentage of tumor volume reduction with the elapsed time after irradiation and the pattern of tumor volume reduction. The median follow-up time was 103.5 months (range, 29.6-137.3 months). The mean pre-radiation therapy tumor volume was 28.60 cm³ (range, 1.34-167.35 cm³). Tumor volume reduction was observed in 96.2% of the study population. The mean absolute and relative tumor volume reduction were 13.9 cm³ (range, 0.4-84.5 cm³) and 44.6% (range, 14.7-89.0%), respectively. After irradiation, the tumor volume reduction rate was 8.02% per year. Meningiomas that were ≥40 cm³ showed a higher rate of...