Quantification of the impact of electrons transport model on DVH metrics and radiobiological indices for lung radiotherapy plans

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The purpose of this work is to evaluate and quantify the impact of calculation of electrons transport on dose distribution and radiobiological predictions for lung radiotherapy. The dose was calculated using Modified Batho (PB-MB) method and Anisotropic Analytical Algorithm (AAA). Dose parameters derived from DVH for target and lung were compared. To compare dose distribution, 2D gamma (γ) index was applied. The radiobiological indices, TCP and NTCP, were also compared using EUD model. Spearman’s rank test was used to explore the best correlation coefficient (r) predicting the dose difference. The bootstrap method was used to estimate the 95% confidence intervals. Wilcoxon paired test was used to calculate p-values. For the same prescribed dose to the PTV, the plans generated with AAA predicted less dose in the target and a more heterogeneous dose distribution inside the target with p<0.05. However, MB predicted a better coverage of the target. The γ analysis showed that the difference between MB and AAA could reach up to ±10%. The MB overestimated the TCP while underestimating the NTCP with p<0.05. The data showed a good correlation between TCP and D95%, as well as NTCP with mean dose, V20 and V30 with r>0.7. The electrons’ transport taken into account by calculation algorithm as AAA showed a significant impact on delivered dose, dose distribution and TCP/NTCP. Readjusting the prescribed dose and a better optimization to protect the organs at risks should be considered in order to obtain the best clinical outcome when using AAA.

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