

AbstractID: 8315 Title: Monte Carlo calculations of dose distribution in NSCLC patients planned for stereotactic body radiation therapy

Purpose: To quantify the accuracy of dose distributions produced according to the stereotactic body radiation therapy (SBRT) protocol BR25 using Monte Carlo (MC).

Method and Materials: Eleven NSCLC patients previously treated with conventional radiotherapy, were selected as suitable for SBRT. For each patient three plans were produced in Eclipse TPS. Plan 1 was based on the BR25 protocol, i.e., a conformal plan with no inhomogeneity corrections. Plan 2 had inhomogeneity corrections enabled, but was otherwise identical to plan 1 (as QA requirement for the RTOG 0618 protocol). Plan 3 designed to meet planning objectives with inhomogeneity corrections enabled. Dose distribution from MC simulations for plans 2 and 3 were compared with those generated in Eclipse for target volumes and normal lung. Equivalent uniform dose (EUD) was calculated for PTV, and normal lung minus GTV. V_{20} was calculated for normal lung minus GTV.

Results: Underdosing of PTV was observed in the MC simulations of Eclipse plans. While planning without inhomogeneity corrections gave the desired 100% PTV coverage with 95% of the prescription dose, MC simulation showed that typically less than 90% of the PTV was actually covered with this dose. For a representative patient, the PTV EUD was 60Gy as planned, 61.4Gy if the same plan was calculated with inhomogeneity enabled, and 58.8Gy if MC calculation was used. This underdosing was more pronounced for plans generated with inhomogeneity correction enabled: planned EUD=60.8Gy, and MC EUD=58.6Gy.

Conclusions: Current SBRT protocols require that no inhomogeneity corrections are to be applied, which is a better choice than allowing inhomogeneity corrections. However, producing plans with inhomogeneity corrections for QA purposes, as required in these protocols, leads to misrepresentative dose distributions because of improper accounting for lack of backscatter and lateral electronic equilibrium. MC-based dose calculation should be recommended as a QA tool for lung SBRT.