AbstractID: 9304 Title: Online re-planning using direct machine parameter optimization: a non-human primate lung irradiation study

Purpose: Establish the feasibility of CBCT-based, online re-planning using direct machine parameter optimization (DMPO) to irradiate the total lung parenchyma in non-human primates (NHPs). A study of acute-radiation-exposure-induced pneumonitis in NHPs involves total lung irradiation (TLI) to 12.5 Gy in a single session, where acute radiation exposure may also lead to the lethal hematopoeitic and gastrointestinal subsyndromes. The latter syndromes occur at 7-8 Gy and at 12-14 Gy, respectively, 1 and 2 weeks after irradiation. Hence, high dose conformity is essential to spare bone marrow, cord and bowel.

Method and Materials: An offline DMPO plan is created on a CBCT scan of the NHP several days prior to the TLI session; using seven, 6MV photon beams. TLI targets a PTV from a 1 cm expansion of lung contours, sparing tissues outside the PTV. On the day of the irradiation a new CBCT is acquired, loaded into the planning system, and contours and DMPO dose objectives are propagated from the offline plan. DMPO is executed online using the original off-line plan as starting points and the resultant on-line plan is compared to the offline plan, on a Philips Pinnacle 8.1v workstation.

Results: Online- and offline-planned DMPO plans achieve V95 > 95% coverage of the PTV, and excellent bowel sparing. However, offline-planned DMPO delivers > 7 Gy to more than 50% of the cord volume, while online-planned DMPO delivers < 6 Gy to more than 50 % of the cord. Online DMPO re-optimization from scanning to the start of irradiation takes less than 45 minutes.

Conclusion: Online DMPO-based re-planning of NHP total lung irradiations is established in support of a study of radiation-induced pneumonitis in non-human primates. Online-planning on NHPs is valuable experience prior to clinical implementation in human patients.

Conflict of Interest (only if applicable): NONE.