Adaptive radiotherapy for soft tissue changes during helical tomotherapy for head and neck cancer.

The goal of the present study was to assess the frequency and impact of replanning triggered solely by soft tissue changes observed on the daily setup mega-voltage CT (MVCT) in head and neck cancer (H&N) helical tomotherapy (HT). A total of 11 patients underwent adaptive radiotherapy (ART) using MVCT. Preconditions were a soft tissue change > 0.5 cm and a tight mask. The dose-volume histograms (DVHs) derived from the initial planning kVCT (inPlan), the recalculated DVHs of the fraction (fx) when replanning was decided (actSit) and the DVHs of the new plan (adaptPlan) were compared. Assessed were the following: maximum dose (Dmax), minimum dose (Dmin), and mean dose (Dmean) to the planning target volume (PTV) normalized to the prescribed dose; the Dmean/fx to the parotid glands (PG), oral cavity (OC), and larynx (Lx); and the Dmax/fx to the spinal cord (SC) in Gy/fx. No patient had palpable soft tissue changes. The median weight loss at the moment of replanning was 2.3 kg. The median PTV Dmean was 100% for inPlan, 103% for actSit, and 100% for adaptPlan. The PTV was always covered by the prescribed dose. A statistically significant increase was noted for all organs at risk (OAR) in the actSit. The Dmean to the Lx, the Dmean to the OC and the Dmax to the SC were statistically better in the adaptPlan. No statistically significant improvement was achieved by ART for the PGs. No significant correlations between weight and
volume loss or between the volume changes of the organs to each other were observed, except a strong positive correlation of the shrinkage of the PGs (\( \gamma = +0.77, p = 0.005 \)). Soft tissue shrinkage without clinical palpable changes will not affect the coverage of the PTV, but translates into a higher delivered dose to the PTV itself and the normal tissue outside the PTV. The gain by ART in individual patients—especially in patients who receive doses close to the tolerance doses of the OAR—could be substantial.

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