

AbstractID: 8469 Title: Radiobiological investigation of the dosimetric effects of daily Megavoltage CT registration techniques on adaptive radiotherapy with Helical Tomotherapy

Purpose: Pre-treatment patient repositioning in highly conformal radiotherapy modalities is a prerequisite for reducing setup uncertainties. A MVCT image set has to be acquired to account for daily changes in the patient's internal anatomy and setup position. This study aims to investigate the expected effect of patient setup correction with the Hi-Art tomotherapy system by using radiobiological measures.

Materials and Methods: Using the Planned Adaptive module (tomotherapy, Inc, Madison, WI), eventual dose discrepancies can be evaluated and corrected. In this study, patients treated for lung, pancreas and prostate carcinomas by Helical Tomotherapy plans are evaluated. In each cancer case, two dose distributions with and without patient setup correction were calculated using the MVCT image sets and they were evaluated using the complication-free tumor control probability (P_c) and biologically effective uniform dose (BEUD) concepts.

Results: For the lung cancer case, at the optimum dose levels of the two dose distributions, the P_c value is 57.6% and 56.8% for a BEUD_{ITV} of 64.8 Gy, respectively. The respective total control probabilities, P_B are 78.1% and 78.1%, whereas the corresponding total complication probabilities, P_I are 20.5% and 21.3%. For the pancreas cancer case, the P_c value is 95.0% for a BEUD_{ITV} of 67.9 Gy and 97.5% for a BEUD_{ITV} of 69.9 Gy, respectively. The respective P_B values are 97.8% and 98.7%, whereas the P_I values are 2.9% and 1.2%. For the prostate cancer case, the P_c value is 57.7% for a BEUD_{ITV} of 90.2 Gy and 55.9% for a BEUD_{ITV} of 90.6 Gy, respectively. The respective P_B values are 83.7% and 84.7%, whereas the P_I values are 26.1% and 28.8%.

Conclusions: According to our results, patient setup corrections during registration are adequate to produce the necessary target localization. Clinical cases, which look dosimetrically similar, can be quite different in radiobiological terms.