

AbstractID: 4800 Title: Dosimetric effect of patient rotational setup errors on prostate IMRT plans

Purpose: To determine dose delivery errors that could result from systematic and random rotational setup errors for prostate patients treated with IMRT.

Methods and Materials: Five prostate cancer patients treated with IMRT technique had their dose distributions re-evaluated to assess the impact of systematic and random rotational setup errors. The IMRT treatments were delivered in three phases: 54 Gy to 95% of PTV1 (prostate and seminal vesicle plus a 10mm margin), 16.2 Gy to 95% of PTV2 (prostate plus a 5mm margin), and 5.4Gy to 95% of PTV3 (which was PTV2 excluding rectum). Rotational setup error can be equivalently simulated with matrix transformed equations by using the gantry, collimator and couch angles of treatment beams. Systematic rotational setup error $\Delta\Phi$ was simulated around each of the three Cartesian axes (denoted as $\Delta\Phi_{LR}$, $\Delta\Phi_{AP}$, $\Delta\Phi_{SI}$) respectively. The dosimetric effect of random rotational setup error ($\Delta\sigma$) was also simulated with normal probability distribution. Various dosimetric parameters for the targets and surrounding normal organs were evaluated with respect to the IMRT plan used for treatment.

Results: The cumulative dosimetric deviations of target (prostate) were within 1% when $\Delta\Phi$ and $\Delta\sigma$ were up to $\pm 5^\circ$ and 3° respectively. For OARs, when $\Delta\Phi_{LR}=\Delta\Phi_{AP}=\Delta\Phi_{SI}=5^\circ$ was simulated, the V_{40Gy} and V_{70Gy} of rectum deviated by $5.8\pm 3.6\%$ and $6.1\pm 11.8\%$ respectively, the V_{40Gy} and V_{65Gy} of bladder deviated by $-1.0\pm 2.9\%$ and $-1.9\pm 4.4\%$. When $\Delta\sigma_{LR}=\Delta\sigma_{AP}=\Delta\sigma_{SI}=3^\circ$ was simulated, the V_{40Gy} and V_{70Gy} of rectum deviated by $-0.4\pm 0.4\%$ and $-2.9\pm 3.2\%$, the V_{40Gy} and V_{65Gy} of bladder deviated by $1.6\pm 1.5\%$ and $0.6\pm 1.5\%$.

Conclusions: For three phases sequential boost prostate IMRT technique, the rotational setup errors do not have a significant dosimetric impact on the cumulative target coverage when $\Delta\Phi$ and $\Delta\sigma$ were up to $\pm 5^\circ$ and 3° respectively. However, reduction of rotational setup errors can decrease doses to surrounding normal structures.