AbstractID: 4920 Title: Monte Carlo Investigation of Dose Perturbation by Hip Replacements in Intensity Modulated Radiotherapy of Prostate Cancer

Purpose:

To quantify the effects of hip replacements (prostheses) on IMRT dose distributions for prostate cancer and to determine their dose perturbations in IMRT treatment caused by the daily setup uncertainty and the inter-fractional motion of prostate.

Method and Materials:

Different IMRT plans were generated with different beam arrangements for each selected prostate cancer patient with a hip prosthesis, and both uniform geometry and a bulk-density assignment to the prosthesis were used in the planning dose calculation. Those plans were then recomputed on the EGS4 based Monte Carlo planning system with the shifts of the position of the prostates and isocenter, which were used to simulate the uncertainties in the daily routine treatment. Results were compared with and without the shifts for the same plans or between plans with uniform geometry and bulk-density assignment to the prosthesis. Isodose distributions and DVHs were used to quantify the perturbations of dose caused by the hip replacements.

Results:

For the IMRT plans with one lateral beam passing through or close by the prosthesis, our results showed that the dose perturbations caused by the internal movement of the prostate and the uncertainty in patient positioning could be clinically significant. Since the intensity for the beam passing through the prosthesis is highly modulated in the optimization due to the high density of the prosthesis, the changes on the uniformity of the dose to the target and the effects to the critical structures were more significant compared with the plan without the presence of a hip prosthesis.

Conclusions:

This work indicates that the potential significant dose perturbations could happen due to setup uncertainties and inter-fractional motion of the prostate in the presence of a hip prosthesis for the treatment of prostate cancer.