

AbstractID: 13288 Title: Voxel-based Imaging Analysis for Quantitative Characterization of Post-implant Prostate Edema in Permanent Prostate Brachytherapy

Purpose: Edema-induced tissue and source movements can introduce significant deviations in the dose delivered to individual patients. Nonetheless, prostate edema has remained as one of the most unpredictable factors. This work is to develop and test a voxel-based imaging analysis approach for quantitative analysis and characterization of prostate edema for patient-specific post-implant dosimetry. **Method and Materials:** Post-implant serial CT imaging was used to describe the 3D evolution of prostate edema. The CT images were acquired at approximately 2-hours, 1-, 6-, 11-, 15-, 30-, and 42-days after the source implantation. The BioImage Suite software (www.bioimagesuite.org) was used to register and analyze the serial image datasets. Rigid image registrations were performed initially for each consecutive pairs of seven CT datasets so that the prostate in each image dataset was aligned in a common coordinate system. Deformable image registration was then performed for each pair of the re-aligned consecutive images. The deformation matrices obtained for the consecutive image pairs were used for quantitative analysis of edema evolution characteristics on a voxel-by-voxel basis. **Results:** An imaging analysis framework for post-implant serial CT images has been implemented. The application of this approach was illustrated using real patient datasets. The accuracy of image registration algorithms was tested using simulated datasets with known rigid-body displacements and tissue deformations. Initial analysis of the deformation matrices obtained from the patient datasets showed that the implanted radioactive sources moved mostly with tissue with little relative migration during edema resolution and the edema resolution was anisotropic. **Conclusions:** A voxel-based image registration and analysis approach has been developed for quantitative characterization of patient-specific post-implant edema evolution. The spatial correspondence established by the deformation matrices among the voxels sampled at different edema resolution stages would enable accurate calculation and proper summation of radiation doses delivered to each tumor sub-volume in post-implant dosimetry.