AbstractID: 13708 Title: Using MRI-based Deformable Image Registration to Accumulate 3D Total Dose Distribution From Intracavitary Brachytherapy Fractions of Cervical Cancer

Purpose: Estimating the total dose delivered to organs-at-risk (OAR) for a whole course of intracavitary-brachytherapy (ICBT) is typically done by summing doses at reference points and/or doses to 2cc of OAR derived from DVH. The purpose of this study was to demonstrate a procedure using deformable image registration to calculate the final 3D dose distribution and use the information to accurately determine the dose to the entire OAR.

Methods and Materials: One patient who received six fractions of HDR-ICBT for cervical cancer was selected in retrospective analysis. T2-weighted MRI images were acquired and used to plan each treatment. ICRU bladder and rectum points along with Point A (L+R) were determined using the images and doses at the points for each fraction. Axial images with their corresponding contours and 3D dose were exported and transferred into our in-house deformable registration software. We used the first fraction as the reference and deformed all subsequent images to it. Using the deformation field, doses from each fraction were summed to obtain the total ICBT course dose.

Results: Visual inspection of the deformed images showed very good matching in the regions of interest for ICBT (superior of bladder toward the inferior of rectum) when compared to the reference image. Using ICRU points and summing the dose from each fraction, Point A left, Point A right, bladder, and rectum doses were 39.7, 41.0, 47.7, and 34.6Gy, respectively. After the doses are deformed and summed, the doses were 41.1, 43.5, 38.7, and 40.38Gy, respectively. The DVH of the summed dose showed that the D_{2cc} (hot spot) bladder and rectum were 38.3 and 47.9Gy, respectively.

Conclusion: We demonstrated the feasibility to use a deformable image registration method to accumulate delivered doses from each brachytherapy treatment fraction by using the treatment planning MRI images acquired prior to each treatment.