AbstractID: 8936 Title: Image Guided Radiotherapy of the Cervix with Biomechanical Model-Based Deformable Registration

Purpose: Evaluate the potential geometric and dosimetric improvements in image-guided radiotherapy of the cervix using deformable registration. **Methods and Materials**: Weekly MR images obtained prior to and during radiotherapy for 29 women with cervix cancer were selected. The bladder, rectum, and GTV were contoured on each image following rigid, bony anatomy based registration. Deformable registration was performed using MORFEUS, a multi-organ finite element model-based deformable registration algorithm. The bladder and rectum were explicitly registered between planning and each week. The GTV displacement was estimated by the biomechanical model and the bladder and rectum displacement. The improvements using couch shifts based on deformable registration were assessed using 3 metrics: 1) improvement in localization of tumor COM, 2) improvements in GTV coverage by the PTV, and 3) improvements in the dosimetric coverage of the GTV and CTV accumulated over the treatment using deformable dose accumulation in ORBIT Workstation. **Results**: The average error in COM alignment of the tumor improved by 0.3, 2.1, and 1.1 mm in the LR, AP, and SI directions, respectively with deformable registration. Following bony registration, 69% of GTVs were at least 95% covered by the PTV, improving to 86% following deformable registration. Dosimetric coverage of the GTV improved from 93% of patients achieving 98% volume coverage by 4900 cGy to 100% following deformable registration-based couch shift for tumor COM correction. CTV coverage improved from 83% of patients achieving 98% volume coverage by 4750 cGy to 93% following deformable registration-based couch shift for tumor COM correction. **Conclusions**: A method has been developed to perform deformable registration of surrounding anatomy to calculate the COM of the tumor for application in volumetric image guidance where the tumor is not visible. Both geometric and dosimetric improvements were demonstrated.

Supported by RaySearch Laboratories and National Cancer Institute of Canada - Terry Fox Foundation.