AbstractID: 9318 Title: MRI-Guided Adaptive Brachytherapy of Cervical Cancer: Initial Experience with High Resolution Diffusion Imaging

Purpose: MRI has the potential to provide wealthy information related to tumor biology and function, and therefore is the idea imaging modality to provide accurate guidance for radiotherapy. The purpose of this study is to develop and integrate a high resolution diffusion imaging protocol into clinical treatment planning for image-guided adaptive brachytherapy of cervical cancer.

Methods and Materials: MR imaging was performed on a clinical 1.5T system using a four-element phased array RF coil. Patients who underwent routine MRI simulation in conjunction with their weekly brachytherapy treatments were included in the study. Brachytherapy was performed with MRI-compatible tandem and ovoid applicators, and MRI was performed right after placement of the applicators, but before the treatment. In additional to T2-weighted TSE sequences for routine treatment planning purposes, high resolution diffusion-weighted images were also acquired. Diffusion images in the form of apparent diffusion coefficient (ADC) maps were computed, and evaluated along with treatment planning using Brachyvision. The add-on values of ADC maps for treatment planning were assessed.

Results: Diffusion imaging was successfully performed on all the selected patients using DW-EPI sequence without obvious distortion artifacts from the applicators. Overall image qualities were analyzed, and the diffusion gradient b-value for optimal tumor delineation was found to be 800 to 1000. When b-value increased, the signal contrast between the tumor and adjacent normal tissue became stronger, however, image became noisier. With the optimized protocol, ADC maps provided better tumor delineation than T2-weighted images for treatment plan optimization.

Conclusion:
High resolution diffusion imaging provided physiological information for tumor and normal tissue, which is less achievable by other imaging modalities. The ADC maps offered excellent image sets for not only depicting the tumor extend for adaptive treatment optimization, but also assessing the overall tissue physiological changes during the treatment course.