

Purpose: For cervical cancer patients treated by MR-guided HDR brachytherapy, the accuracy of radiation delivery depends on accurate localization of both tumors and the “tandem and ovoid” applicator. Although T2-weighted (T2W) MRI has a good tumor contrast, it is not a good choice for defining the applicator because of signal dropout and geometric distortion around the titanium applicator. In this study, we evaluated the possibility of using proton density weighted (PDW) MRI to improve the definition of the applicator.

Methods: Both T2W and PDW images in the para-sagittal plane were obtained from a 1.5T MRI scanner. For both images sets, in-plane resolution was 1mm*1mm, spacing between slices was 0mm, TR was set to be between 3000ms and 6000ms, and FOV and the number of slices was adjusted based on the anatomy of individual patients. TE was 90ms and 5.5ms; slice thickness was 5mm and 2.5mm for T2W and PDW MRI respectively. PDW MRI had a smaller coverage in R/L direction. Images were sent to a workstation for treatment planning and another workstation after de-identification for further image analysis.

Results: Images from 10 patients were retrospectively reviewed. PDW MRI had a better definition of the applicator for all cases. A smaller ROI was placed around the tip of the tandem, which only included two structures: the tandem and the uterus. Histograms of signal intensity within the ROI showed that two peaks corresponding to the two structures were clearly separated in PDW MRI but not in T2W MRI.

Conclusions: We showed that PDW MRI could provide a good visualization of the applicator. Therefore, we recommend adding PDW MRI to the imaging protocol for MR-guided radiotherapy for cervical cancer. This will enable us to precisely localize both tumors and the applicator, which is essential for ensuring dose delivery accuracy.