2913 The Dependence of Apparent Diffusion Coefficient on B-values and Voxel Location

L. Ewell, N. Vijayakumar

University of Arizona, Tucson, AZ

Using Diffusion Weighted Magnetic Resonance Imaging (DWMRI), it has recently become possible to calculate an Apparent Diffusion Coefficient (ADC) for a Region of Interest (ROI). If the ROI is a tumor, the ADC has found utility as a way to monitor efficacy of radiotherapy. A common method of determining an ADC uses two values of diffusion, often b = 0 and 1,000 s/mm^2. This method assumes a linear relationship between the ADC and b-values. By using three different b-values, 0, 520 and 850 s/mm^2, we have employed linear regression to determine the ADC which should, in principal, yield a more accurate value. Utilizing axial MRI brain scans, we have divided the brain into 1 cm^2 ROIs, for which we have calculated values of the ADC. Furthermore, we have subdivided the scan area into a medial/central region and a lateral/posterior/anterior region. A sample of these divisions can be seen in Figure 1. For the medial/central region, we see little difference between using two b-values (0 and 850 s/mm^2), and three: (Average ADC_3)/(Average ADC_2) = 0.999 ± 0.023 (SD). However, for the more lateral/posterior/anterior voxels, we see that using three b-values yields a lower result for the ADC: (Average ADC_3)/(Average ADC_2) = 0.866 ± 0.19 (SD). This difference can be seen in Figure 2, where we plot this ratio as a function of column number for central rows of voxels. We are investigating the potential reasons behind this difference, including volume averaging effects. The goal of this work is to determine how best to calculate values of ADC when monitoring efficacy of radiotherapy for brain disease.

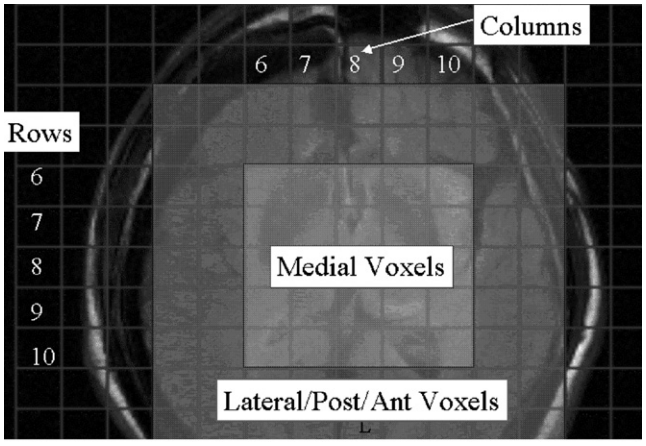

Figure 1: Voxel Division

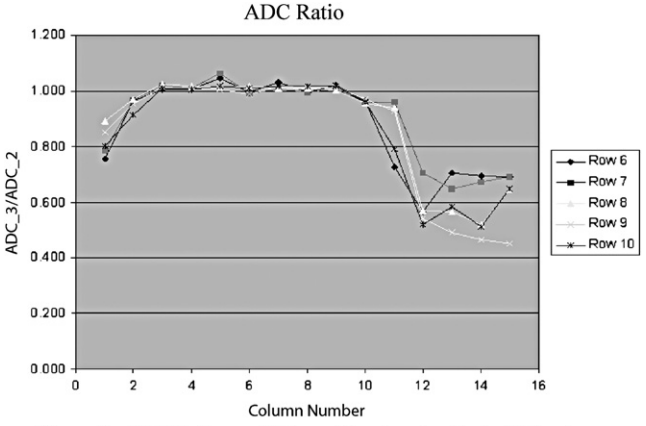

Figure 2: ADC Ratio vs. Column Number for Central Voxels

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2914 A Two-Stage IMRT Treatment Protocol Provides More Robust Radiotherapy for Prostate Cancer in Presence of Inter- and Intra-Fractional Organ Motions

Z. Chen, J. Deng, R. Nath, R. Peschel

Yale University School of Medicine, New Haven, CT

Purpose/Objective(s): Recent studies on organ motion using daily CT imaging and continuous intra-fractional monitoring of surgically implanted electromagnetic transponders have revealed significant and patient-dependent inter- and intra-fraction movement of prostate during radiation therapy. The aim of this work was to investigate the robustness of a two-stage treatment protocol for intensity-modulated radiation therapy (IMRT) of prostate cancer in presence of these organ motions.