AbstractID: 11385 Title: Implications of Radiation Treatment Planning Based on Apparent Diffusion Coefficient Map for Malignant Brain Tumors

Purpose: We investigated feasibility and advantage of integrating apparent diffusion coefficient (ADC) map for radiation palnning to determine the dose escalation region and evaluated the biolgocial planning reflected on tumor malignancy.
Method and Materials: Multimodal image sets of glioma and astrocytoma were acquired with CT, contrast-enhanced T1, fluid attenuated inversion recovery (FLARE), and diffusion weighted (DW) magnetic resonance (MR) images. ADC map was obtained from DW images and it was converted into the ADC ratio map divided by the average ADC of normal parenchyma in contralateral brain. ADC ratio was used as quantitative criteria representing tumor malignancy and gross tumor volume (GTV) was differentiated by the level of the ADC ratio. GTV of each mulimodal images and stratified regions by ADC ratio were registered on CT using rigid registration. The biological planning using multmodal images was assessed by dose volume histogram and normal tissue complication probability (NTCP).
Results: Multimodal images and ADC ratio map were complementary to describe more reliable tumor contour. More progreesed tumor region was distinguished in GTV and location of the most malignant tumor in 3D space was also resolved using the profile of ADC ratio. The advanced radiation treatment planning reflected on biological tumor characteristic was performed using the ADC map and dose escalation was achieved with similar NTCP level of conventional planning.
Conclusion: ADC ratio was useful to stratify the tumor in regard to malignancy and it was suggeted a quantitative biological criteria to dermine the dose escalation region for effective treatment results. Biological treatment planning based on the ADC ratio map could support practical adaptive radiation therapy.