

## Diffusion tensor imaging of normal appearing WM in treated oligodendrogliomas

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### Background and Purpose

Previous studies have concentrated mostly on the DTI of untreated gliomas. Fractional anisotropy (FA) values vary greatly across the cerebral white matter regions. The existing studies have compared FA values mostly in different locations of the brain and in heterogeneous groups of tumors.

Our aim was to measure the diffusion-tensor imaging characteristics in a fixed location in treated oligodendrogliomas of the frontal lobe.

### Methods and Materials

A total of 12 patients with a frontal lobe oligodendroglioma were imaged after surgery and irradiation treatment. 3D SPGR, T1 with and without gadolinium enhancement, FLAIR and DTI EPI sequence with diffusion gradient applied in 9 (b=1000) or 33 (b=700) directions were acquired on a 1.5T GE Signa MR unit. Fractional anisotropy (FA), apparent diffusion coefficient (ADC) and T2 maps were created from DTI data. Regions of interest (ROIs) were placed in one of the outgoing white matter tracts of the frontal lobe – the anterior limb of the internal capsule. The WM tracts were normal appearing on T2 weighted images in all of the patients included in the study. Values were compared to the contralateral sides.

### Results

Mean FA values in the anterior limb of the internal capsule on the normal side were 0.56 (SD=0.039). Mean FA values in the anterior limb of the internal capsule on the side of the tumor were 0.49 (SD=0.066) – 87% of normal value (p=0.01). Mean ADCs in the anterior limb of the internal capsule ipsilateral to the tumor were  $0.821 \times 10^{-3} \text{ mm}^2/\text{sec}$  (SD=0.064). Mean ADC values in the anterior limb of the internal capsule on the side of the tumor were  $0.884 \times 10^{-3} \text{ mm}^2/\text{sec}$  (SD=0.091). The difference was not statistically significant (p=0.08). Mean T2 values (arbitrary) were 268 (SD=45) on the normal side and 276 (SD=24) on the pathological side. The difference was not significant (p=0.41)

### Discussion

T2 values in vivo mostly depend on the water content of the tissue. ADC values depend primarily on the free extracellular water content (11). Our results are consistent with what has been described in gliomas in previous studies (4-9). The difference in FA between the sides could not be due just to vasogenic edema, as the total water content (T2 value) was the same and there was no significant increase in free extracellular water (ADC value). The difference in FA in the normal appearing white matter tracts was probably caused by tumor infiltration beyond visible abnormality on the T2 images – disruption of the myelin sheaths and the disorganization of axons.

### Conclusion

Fractional anisotropy was lower in normal appearing white matter tracts connecting to the region of the tumor than on the contralateral side in oligodendrogliomas after treatment. Further studies will be needed to evaluate a possible use of diffusion tensor imaging characteristics in the follow-up of treated oligodendrogliomas.

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