A study of optimal diffusion indices to differentiate between low and high grade in non-enhancing cerebral gliomas and neuronal- glial tumors.

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Background and Purpose: Malignant, non-enhancing supratentorial gliomas (G) and neuronal-glial (NG) tumors are sometimes misdiagnosed as low grade tumors. Earlier studies have indicated that up to 45% of the non-enhancing supratentorial gliomas are malignant. Diffusion tensor imaging (DTI) can supply multiple diffusion indices of which minimal apparent diffusion coefficient (ADC) and ratio Fractional anisotropy (FA) have been reported to differentiate between low and high grade gliomas. The aim of this study was to evaluate the diffusion indices from DTI with regard to their ability to distinguish between low and high grade tumors.

Method and materials: 25 patients with pathology confirmed non-enhancing supratentorial gliomas and neuronal-glial tumors were included. 14 patients had a low grade tumor (WHO grade 1and 2) and 11 with high grade (WHO grade 3 and 4). Besides a region of interest (ROI) covering the entire tumor, additional smaller ROIs, 20 - 30 voxels each, were placed inside the tumor to measure the maximal FA and minimal ADC. The same size ROIs were placed on the contralateral side for reference. The mean, maximal and mean maximal FA as well as mean, minimal and mean minimal ADC values were measured. The ratios for all FA and ADC values were also calculated (diffusion index value in the lesion side/ the contralateral side). The difference between the low and high grade groups for each diffusion index was analyzed by Mann-Whitney U test, and receiver operating characteristic (ROC) analyses was performed for optimal grading threshold.

Results: There was a significant difference between low and high grade in non-enhancing supratentorial gliomas and neuronal-glial tumors for all FA values as well as FA ratios (*p* values varied between 0.000 and 0.008), but not for any of the ADC indices. The mean maximal and maximal FA values showed better separation between low and high grade. Furthermore, a ROC analysis showed that a mean maximal FA value of 0.238 separated between low and high grade with a sensitivity of 90.9% and a specificity of 100%. The similarly calculated threshold for the maximal FA value was 0.243 which resulted in a sensitivity of 90.9% and a specificity of 93%.

Conclusions: This study shows a significant difference for all measured and calculated FA indices when comparing low and high grade in non-enhancing supratentorial gliomas and neuronal-glial tumors. The mean maximal FA and maximal FA values showed the best separation which, if it can be established in future studies could make them valuable diagnostic tools for grading of non-enhancing supratentorial gliomas and neuronal-glial tumors.

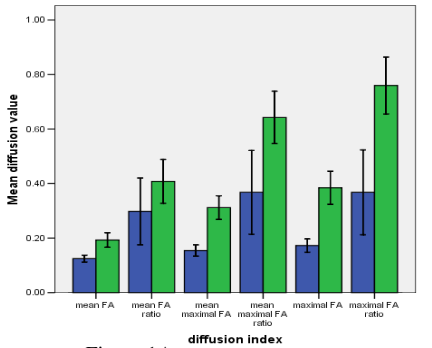

Figure 1A

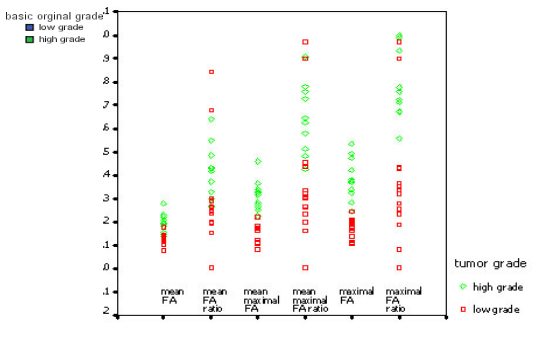

Figure 1B

Figure 1, Figure 1A: Bar plot; Figure 1B: Scatter plot of mean FA, mean FA ratio, mean maximal FA, mean maximal FA ratio, maximal FA and maximal FA ratio. There was significant difference for all these indices between low and high grade in non-enhancing supratentorial gliomas and neuronal-glial tumors.