

Comparison study of MR perfusion imaging and diffusion tensor imaging in the grading of non-enhancing cerebral gliomas

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Background and Purpose: Of all non-enhancing supratentorial gliomas, 14-45% are graded as malignant (WHO grade 3 and 4), but they are not uncommonly misdiagnosed as low grade (WHO grade 1 and 2) because of their lack of enhancement. The purpose of this study was to establish the value of MR perfusion weighted imaging (PWI) and diffusion tensor imaging (DTI) in differentiating between low and high grade non-enhancing supratentorial gliomas.

Method and materials: Thirty-nine patients with pathology confirmed non-enhancing supratentorial gliomas, whose examinations included dynamic susceptibility contrast (DSC)-GRE-PWI and DTI data, were included in the study. There were 21 patients with low grade and 18 with high grade tumors. The relative cerebral blood volume (rCBV), mean and maximal Fractional anisotropy (FA), and mean trace apparent diffusion coefficients (trace ADC) within the tumors were calculated and compared using Mann-Whitney U test.

Results: The maximal FA and mean FA in the high grade group (0.386 ± 0.133 and 0.124 ± 0.011 , resp.) were significantly higher ($P=0.000$) than in the low grade group (0.180 ± 0.033 and 0.189 ± 0.04 , resp.). The maximal rCBV in the high grade group was 2.168 ± 1.417 and mean trace ADC was 1.274 ± 0.239 , which compares to an rCBV of 1.884 ± 1.470 and a mean trace ADC of 1.358 ± 0.531 in the low grade group. However, there was no significant difference between the two groups with regard to either maximal rCBV or mean trace ADC ($P>0.05$). Classify discrimination analysis was performed showing that a maximal FA threshold of 0.243 could differentiate between high grade and low grade non-enhancing supratentorial gliomas with a sensitivity of 90% and specificity of 90%. Also a mean FA threshold of 0.141 showed a sensitivity as well as specificity of 90%. In contrast to this, the maximal rCBV, using the common threshold of 1.75 showed only a sensitivity of 46.5% and specificity of 40%, and for mean trace ADC sensitivity and specificity using a threshold of 1.239 was only 60% and 40%, respectively.

Conclusions: PWI alone, with the common threshold of rCBV ratio of 1.75, was not sufficient to grade the non-enhancing supratentorial gliomas. The maximal and average FA may be better surrogate markers than mean trace ADC and rCBV, if used alone.

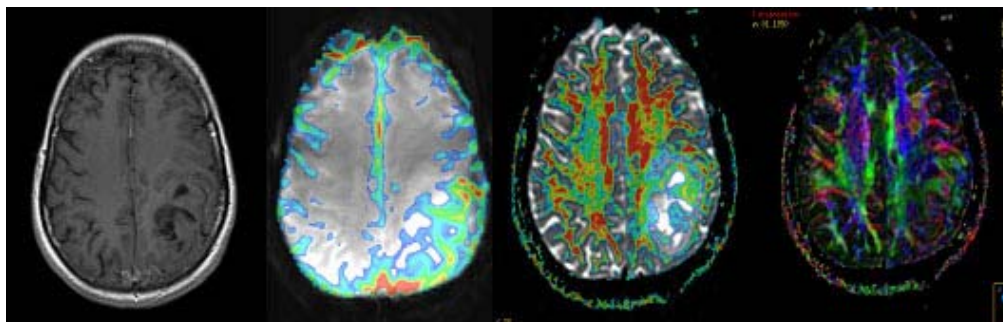


Figure 1A

Figure 1B

Figure 1C

Figure 1D

Figure 1: Figure 1A: post contrast T1WI image, Figure 1B: rCBV image, Figure 1C: scaled FA image (with FA value minimum threshold of 0.215) superimposed on the T2* image, Figure 1D: direction encoded FA image. This was a non-enhancing anaplastic oligoastrocytoma (WHO Grade 3) within the left parietal lobe. The lesion had an increased rCBV and also the FA value within the tumor was increased. Adjacent fibers were disrupted and infiltrated.