Diffusion tensor imaging in tumefactive demyelinating lesions and high grade glioma: A comparative study

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Background and Purpose: It is important to differentiate between tumefactive demyelinating lesions (TDLs) and high grade gliomas to avoid unnecessary surgical procedures. However, this can be difficult on conventional MR imaging alone. Although MR perfusion weighted imaging has been reported to improve the accuracy of the diagnosis, this technique is limited in clinical practice since some patients cannot handle the rapid bolus injection. The aim of this study was to evaluate if diffusion tensor imaging (DTI), one of the new, non-invasive imaging techniques can be of help in differentiating between TDLs and high grade gliomas.

Method and materials: We gathered 11 cases with tumefactive demyelinating disease diagnosed through a combination of laboratory tests, clinical outcome and follow-up imaging for retrospective review. Another 11 patients with morphologically imaging matched and pathology confirmed high grade gliomas were used for comparison. The trace apparent diffusion coefficient (trace ADC) and Fractional anisotropy (FA) calculated in enhanced and unenhanced regions of TDLs as well as in enhanced and centrally unenhanced tumor portions. The main eigenvector of ROIs in perilesional and contralateral regions were assessed. Tractography fiber seeds through the lesions were generated from Trackvis 0.4.2, and the fiber density index (FDi, ratio of fibers amount/seed ROI voxel numbers) was compared between TDL and glioma groups. Differences were analyzed with a non-parameter Mann-Whitney test.

Results: The mean FA value of the enhanced TDLs was 0.193±0.07 and of the unenhanced TDLs it was 0.214±0.04. In contrast, the mean FA value of the enhanced high grade gliomas was 0.131±0.03 and 0.131±0.04 in the unenhanced tumor portions. There was a significant difference of mean FA values between the enhanced high grade gliomas and the enhanced TDLs (P=0.005) as well as between unenhanced high grade glioma regions and unenhanced TDLs (P=0.000). The mean trace ADC value of the enhanced TDLs was 1.048±0.17 and the mean trace ADC value of the unenhanced TDLs was 1.042±0.22 which should be compared with the mean trace ADC value of the enhanced high grade gliomas of 1.12±0.23 and of 1.53±0.26 in unenhanced high grade gliomas. There was no significant difference of mean trace ADC values between enhanced TDL and high grade gliomas, but the mean trace ADC of unenhanced high grade gliomas was significantly higher than unenhanced TDLs (P=0.000). The main eigenvector in peri-TDL regions was similar to the contralateral ROIs, while the main eigenvector in peri-tumoral regions was significantly changed (P<0.01), indicting tumor infiltration and vasogenic edema. The FDi in the high grade gliomas was significant lower than in the TDL group, indicating sever tumor destruction and displacement.

Conclusions: DTI can be useful to assist in differentiating between TDLs and high grade gliomas.

Figure 1: A case with TDL. Figure 2: A patient with glioblastoma. Both T1 post contrast image(Figure 1A and 2A) showed enhancement in the splenium of corpus callosum. The scale FA image(Figure 1B and 2B) showed corresponding FA decrease. But the color directional encoding FA images(Figure 1C and 2C) showed preserved transverse direction in TDL case, while the glioblastoma lost the normal maximal diffusion direction.