Folia Neuropathol. 2010;48(2):81-92.

Differentiation between brain tumor recurrence and radiation injury using perfusion, diffusion-weighted imaging and MR spectroscopy.

Bobek-Billewicz B, Stasik-Pres G, Majchrzak H, Zarudzki L.

Gabriela Stasik-Pres, Maria Sklodowska-Curie Memorial Cancer Center and Institute of Oncology, Gliwice Branch, 44-101 Gliwice, Poland. gabastasik@poczta.onet.pl

Abstract

BACKGROUND: Differentiation between tumor recurrence/vital tumor tissue and radionecrosis based on conventional diagnostic imaging is impossible because of the likeness of the images. In such circumstances advanced MRI techniques (PWI, DWI, 1HMRS) seem to be helpful. The aim of our study was to evaluate the diagnostic effectiveness of PWI, DWI and 1HMRS in the differentiation of the tumor recurrence from radiation related injury. MATERIAL AND METHODS: The retrospective analysis comprised 11 contrast-enhancing lesions observed in 8 patients treated for gliomas with radiotherapy or radiochemotherapy. 5 out of 11 contrast-enhancing lesions were tumor recurrences whereas 6 out of 11 radiation-related injuries. The MR examinations comprised of conventional MR imaging (T1-SE, T1-MPRAGE with CE, T2-TSE, T2 FLAIR) and PWI, DWI, 1HMRS. Mean and maximum rCBV values of each contrast-enhancing lesion were calculated. These values were normalized to normal appearing white matter. Mean normalized ADC ratio to normal appearing white matter and mean ADC obtained from contrast-enhancing lesions were analysed. In 1HMRS only those voxels which were placed in solid part of the contrast-enhancing lesion were analysed and Cho/Cr, Cho/NAA ratios presented. RESULTS: Mean normalized rCBVmax (2.44 +/- 0.73 for tumor recurrence vs. 0.78 +/- 0.46 for radiation injury; p < 0.001) and mean normalized rCBVmean (1.46 +/- 0.49 for tumor recurrence vs. 0.49 +/- 0.38 for radiation injury; p < 0.005) were significantly higher in the recurrent gliomas group than in the radiation injury one. It was observed that normalized rCBVmax higher than 1.7 and normalized rCBVmean higher than 1.25 is highly indicative for recurrent glioma whereas normalized rCBVmax lower than 1.0 and normalized rCBVmean lower than 0.5 is highly indicative for radiation injury. Results obtained in DWI and 1HMRS were not statistically significant different between two analysed groups. Mean ADCce: 1.06 +/- 0.18 x 10-3 mm2/s for tumor recurrence vs. 1.13 +/- 0.13 x 10-3 mm2/s for radiation injury; p = 0.51. Mean normalized ADC: 1.55 +/- 0.39 x 10-3 mm2/s for tumor recurrence vs. 1.55 +/- 0.18 x 10-3 mm2/s for radiation injury; p = 0.98. Median Cho/Cr ratio: (2.16min/max [1.67-3.15] for tumor recurrence vs. 1.34min/max [1.13-2.37] for radiation injury; p = 0.15), median Cho/NAA ratio (1.9min/max [0.86-2.36] for tumor recurrence vs. 2.11min/max [0.97 vs. 2.87] for radiation injury; p = 0.51). CONCLUSIONS: Among the analyzed advanced neuroimaging methods PWI seems to be most reliable in differentiation between tumor regrowth/recurrence and radiation necrosis. In these results mean rCBV is a better differing factor than max rCBV. Proton MR spectroscopy (1HMRS) and DWI do not differentiate analyzed groups with statistical significance, despite tendency to lower ADC values in recurrence group than in radiation injury one.

PMID: 20602289 [PubMed - in process] **Free Article**