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Evaluation of Brain Tumors by Proton MRS Combined with a Spectral Deconvolution Method

김형중, 정광우, 서정진, 강형근, 조성훈, 은성종
전남대학교 의과대학 진단방사선과학교실

목적 : The purpose of this study was to evaluate the usefulness of a single-voxel ^{1}H MRS combined with a spectral deconvolution technique in differential diagnosis and grading of various brain tumor.

대상 및 방법 : Twenty-two patients pathologically confirmed were examined for assessment of brain tumors(astrocytoma 12, meningioma 5 and metastasis 5). All MRS examinations were performed on a 1.5T Signa MR scanner (GE Medical Systems) with a head coil. A STEAM pulse sequence(TR/TE/MT= 3000/30/13.7msec) with 96 scans was used, and the water peak was removed with the use of CHESS pulse sequence. Postprocessing of the raw data was performed by MRUI program(http://www.mrui.uab.es) as follows: the acquired FID was zerofilled, apodized by an exponential function with 6Hz line-broadening, and then Fourier transformed, followed by baseline correction. In quantification of MR spectra, the creatine(Cr, 3.0 ppm) peak was used as a standard to normalize signal intensities of metabolites of interest: N-acetyl aspartate (NAA: 2.0 ppm), total choline(Cho: 3.2 ppm), myo-inositol(mI: 3.6 ppm), α-glutamine & glutamate(α-Glx: 3.6-3.8 ppm), β · γ -glutamine & glutamate(β · γ-Glx: 2.2-2.5 ppm), lactate(Lac: 1.3 ppm).

결과 : In the case of low-grade astrocytoma, the concentration of NAA was reduced by 24% and Lac was markedly elevated by as much as 437% below the normal values; in the high-grade astrocytoma, NAA was reduced by 31%, and Lac, Cho, mI, and α-Glx were elevated by 592%, 142%, 131%, and 99%, respectively, at the significance level with $P<0.05$. In a differential diagnosis between low- and high-grade astrocytoma, elevation of both Cho and mI is significantly($P<0.05$) related with high-grade; while elevation of α-Glx, low-grade astrocytoma. The pattern of metabolite changes in meningioma is similar to that of high-grade astrocytoma in that NAA was reduced by 38% and Lac and Cho were elevated by 470% and 120%($P<0.05$), respectively. However, the pattern of mI, α-Glx, and β · γ-Glx are different from each other; especially the levels of mI and α-Glx are significaly($P<0.05$) important for differential diagnosis between them. In metastasis, the level of NAA remained constant, and both Lac and Cho were elevated significantly($P<0.05$) by 476% and 78%, respectively. The levels of other metabolites except NAA in metastasis were lower than those in high-grade astrocytoma. In a similar way with high-grade astrocytoma, the cyst component associated with high-grade astrocytoma showed the same pattern of concentration changes: reduction of NAA by 21% and elevation of Lac, α-Glx, mI, and Cho by 236%, 100%, 88%, and 16%, respectively, at the significance level with $P<0.15$. However, overall levels of metabolite changes of cyst are smaller than those of high-grade

astrocytoma.

결론 : A spectral deconvolution technique leads to accurate quantification of the cerebral metabolic changes that would be problematic with the conventional apodization processing. This advantage may be a useful clinical tool for diagnosis of brain tumors.