In patients with brain tumors, can the contralateral brain hemisphere be used as control for single-voxel 1H spectroscopy?

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Introduction

Single voxel 1H magnetic resonance spectroscopy (1HMRS) is clinically used to differentiate normal brain and tumor and to evaluate tumoral response to therapy. Frequently, when a brain tumor is studied by MRS, the contralateral brain hemisphere is used as control.

The purpose of this study is to evaluate if the metabolic profile by 1HMRS is the same in normal subjects, without neurological and/or psychiatric disorders, and in the contralateral hemisphere of patients with brain tumors, submitted or not to radio- and/or chemotherapy.

Methods

Twenty-seven subjects were divided in two groups: I) five normal subjects without neurological and/or psychiatric disorders and II) sixteen patients with brain tumors. Group II was subdivided in A) six patients previously submitted to radio- and/or chemotherapy and B) fourteen patients that have not received adjuvant therapy. All subjects were submitted to 1HMRS on a 1.5T General Electric (GE) (Milwaukee, USA). The 1HMRS protocol consisted of single-voxel point resolved spectroscopy (PRESS), with repetition time (TR) of 1500 and echo time (TE) of 144 ms. Eight cc volumes of interest (VOIs)were placed in various brain regions, including gray and white matter. The metabolites N-acetyl-aspartate (NAA), creatine (Cr)and choline (Cho) were quantified using the software PROBE by GE.

Results

The following means and standard deviations (in parenthesis) were obtained for the ratios NAA/Cr, NAA/Cho and Cho/Cr, respectively: Group I (normals): 2.095 (0.245), 1.831 (0.278), 1.159 (0.159); Group IIA (patients with brain tumor, treated with radio/chemotherapy): 1.627 (0.437); 1.639 (0.443); 1.116 (0.268) ; Group IIB (patients with brain tumor, no treatment): 1.866 (0.391), 1.533 (0.367), 1.152 (0.182) ; Group II A+B (patients with brain tumor with or without treatment): 1.791 (0.410); 1.561 (0.378); 1.142 (0.202).

The Kruskal-Wallis non-parametric test showed no significant difference between groups for the ratios NAA/Cho (p=0.9989) and Cr/Cho (p=0.0737). The ratio NAA/Cr was significantly higher in the group I (controls) as compared to the group IIA (patients with brain tumor, treated with radio/chemotherapy); no signifcant difference was observed for the NAA/Cr ratios between groups I and IIB or I and II A+B.

Discussion

1HMRS is used to aid in the differential diagnosis of brain tumors and to evaluate neoplastic response to therapy. Another common use of 1HMRS is to distinguish between imaging changes due to radio/chemotherapy and tumor recurrence. Frequently a table of normal values of metabolic ratios is desired as standard. However, when such a table is not available for the precise location of the lesion, the contralateral brain hemisphere of the patient may be used as control. Our data show that there is a significant reduction of NAA/Cr ratio in the contralateral hemisphere of patients submitted to radio or chemotherapy.

In conclusion, the contralateral brain hemisphere is not suitable as control for 1HMRS in patients with brain tumors submitted to radio or chemotherapy.

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References

Estève, F.; Rubin C.'; Grand, S.; Kolodié, H.; Le Bas J.F. Transient metabolic changes observed with proton MR spectroscopy in normal human brain after radition therapy. Int. J. Radiation Oncology Biol. Phys.; v. 40, p. 279-86, 1998.

Henry, RG; Vigneron, DB; Fischbein, NJ; Grant, PE; Day, MR; Noworoslski, SM; Star-Lack, JM; wald LL; Dillon WP; Chang, SM; Nelson Sj. Comparison of relative cerebral blood volume and proton spectroscopy in patients with treated gliomas. AJNR Am J Neuroradiol, v. 21, p. 357-366,2000.

Wald L.L., Nelson S.J., Day M.R., Noworolski S.E.,Henry R.G., Huhn S.L., Chang S., Prados M.D., Sneed P.K., Larson D.A., Wara W.M., McDermott M., Dillos W.P., Gutin P.H., Vigneron D.B. Serial proton magnetic resonance spectroscopy imaging of glioblastoma multiforme after brachytherapy . J Neurosurg; v. 87, p. 525-34, 1997.

Waldrop S.M., Davis P.C., Padgett C.A., Shapiro M.B., Morris R. Treatment of brain tumors in children is associated with abnormal MR spectroscopic ratios in brain tissue remote from tumor site. AJNR Am J Neuroradiol; v. 19, p. 963-70, 1998.