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Study of the technique of magnetic resonance spectroscopic imaging (MRSI) and application to evaluation of brain metabolites of systemic lupus erythematosus patients

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Abstract
In this study, MRSI was used to assess metabolite levels in the corpus callosum of systemic lupus erythematosus (SLE) patients and healthy subjects. For this, an average spectrum was produced from MRSI data, by combining different sets of spectra, which had different minimum percentages of white matter. The effect of eliminating low signal-to-noise spectra was also tested. With this methodology, it was possible to find a 10% decrease in the concentration ratio NAA+NAAG/Cr+PCr in SLE patients compared to healthy subjects, corroborating results found in previous studies using a single voxel technique.

Key words:
MRSI, corpus callosum, systemic lupus erythematosus.

Introduction

Magnetic resonance spectroscopic imaging (MRSI) allows in vivo measurement of magnetic resonance spectra in a voxel grid positioned over a given anatomical region, which makes it possible to measure brain metabolites, such as N-acetylaspartate and N-acetylaspartylglutamate (NAA+NAAG), creatine and phosphocreatine (Cr+PCr), glycerophosphorylcholine and phosphorylcholine (GPC+PCh). A study carried out by Appenzeller et al. [1] showed that patients with systemic lupus erythematosus (SLE) have a decrease in the ratio NAA+NAAG/Cr+PCr, and an increase in GPC+PCh/Cr+PCr, compared to healthy subjects. These findings were achieved using the magnetic resonance spectroscopy (MRS) technique, with a single-voxel acquisition.

In this study, we used multivoxel spectroscopy (MRSI, magnetic resonance spectroscopy imaging) to evaluate metabolite levels in the corpus callosum of SLE patients and to compare them to those of healthy subjects. We also tested, for the first time, a software, developed by Pereira et al. [2], which automatically matches MRSI data to corresponding anatomical MR images, which is something that was previously only possible to perform at the scanner console.

Results and Discussion

Spectra from 20 patients (mean age 38 ± 16 years) and from an equal number of healthy subjects (mean age 36 ± 11 years), all women, were analyzed. Initially, the MRSI/MRI matching software [2] was used to combine the MR images with the MRSI grids and thus enable the verification of the positioning of the spectra grids, which were, in this case, in the upper region of the corpus callosum, to avoid cerebrospinal fluid. After this, the software allowed the selection of spectra with predetermined percentages of white matter, in this case, 85, 90 and 95%. It was also possible to visualize through the software the spectra that had passed in the previous steps and to remove spectra containing insufficient signal-to-noise ratio (SNR). After this preprocessing of the data, the software generated an average spectrum and the software *LCModel* [3] was used to quantify this spectrum.

The results obtained for the metabolite concentrations for each group (patients and healthy subjects) were compared and, in order to guarantee if the differences between the results of each group were significant, a statistical analysis was performed.

With this methodology, it was possible to observe a 10% decrease in the NAA+NAAG/Cr+PCr ratio in patients with SLE in relation to healthy individuals. However, the only methodology tested in this study that found a statistically significant difference between the groups was the one that used 85% of white matter with the exclusion of noisy spectra.

The results may be explained by the fact that the use of a lower threshold of white matter (85%) for the inclusion of spectra in the average spectrum increases its SNR (since more spectra are included). In addition, the manual exclusion of noisy spectra probably contributed to improve the quality of the average spectrum, allowing a distinction between the groups.

Conclusions

With this work, with a multivoxel technique, it was possible to corroborate one of the results presented in a previous study [1] which used a single voxel technique. Besides, the MRSI/MRI matching software was tested for the first time, and its usefulness was confirmed.

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[1] Appenzeller S. et al., *Arthritis Rheum*. 55(5):807-11, 2006.

[2] Pereira, D. R.; Fritolli, R. B.; Lapa, A. T.; Appenzeller, S.; Lotufo, R. A.; Rittner, L. *Metodologia para seleção de espectros de interesse em espectroscopia multi-voxel por ressonância magnética*. XXV Congresso Brasileiro de Engenharia Biomédica – CBEB, Foz do Iguaçu-PR, 2016.

[3] Provencher SW. *Magn Reson Med*. 30: 672-679, 1993.