Improving Sensitivity of MRS by Motion-Related Error Correction in Patients with Huntington's Disease

Y. Kuznetsov[1], Y. Boulanger[1]
[1]Radiology, Hôpital Saint-Luc du CHUM, Montréal, PQ, Canada

INTRODUCTION

Motion-related peak fitting errors (MFE) are inherent to the analysis of MRS data in patients with hyperkinetic disorders, such as Huntington's disease (HD) or in non-cooperative patients. The involuntary movements (e.g. chorea) during MRS acquisition are the main source of the MFE in HD patients. MFE increase the range of calculated metabolite values and may hamper discriminating between patients and normal controls. Thus, an approach allowing for MFE correction may be useful to improve the distinction between patients suffering from hyperkinetic disorders and normal controls, especially when metabolite ratios are used. Such an approach has been applied to HD patients.

METHODS

MRS acquisition: Fifteen HD patients (30-62 years, mean: 43.9 years; UHDRS scores: 141-345, mean: 224.9), and 12 age and sex matched control subjects underwent bilateral single voxel MRS examination with the PRESS sequence [(TR = 1500 ms, TE = 30 ms, voxel size 2x2x2 cc, 128 acquisitions] of their striatum on a GE 1.5 T imager. MRS data were analyzed using LCModel software which calculates a goodness of fit parameter (%SD = 100 x SD/mean) for each metabolite (1).

Statistical analyses: The MFE correction was performed by weighting NAA/Cr ratios by the corresponding NAA and Cr goodness of fit parameter (%SD) yielding the following ratio: $(NAA/\%SD_{NAA})/(Cr/\%SD_{Cr})$ x 1000. The NAA/Cr ratios were compared between the two groups (i.e. HD patients and normal controls) using two-sample t-test analysis before and after the MFE correction.

RESULTS

No difference in NAA/Cr ratios was detected between HD cases and normal controls before the MFE correction (p = 0.1, Figure 1A) was applied, but NAA/Cr became significantly smaller in HD cases than in normal controls when the MFE correction was performed (p = 0.001, Figure 1B). In addition, the goodness of fit parameters (%SD) for the Cr and NAA concentrations calculated by LCModel were significantly larger in the HD cases than in normal controls (p = 0.003 and 0.03, respectively).

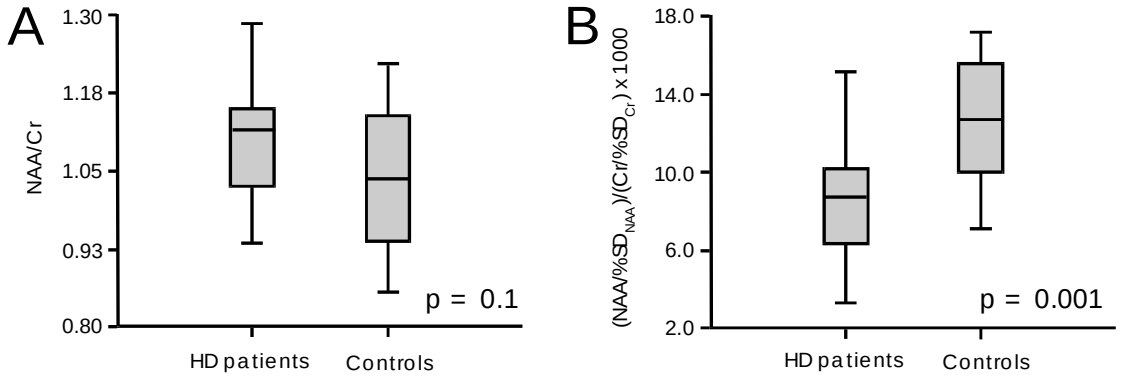

Figure 1. Box plots showing (A) no difference in NAA/Cr ratios between HD patients and normal controls and (B) a statistically significant difference in MFE corrected values of the NAA/Cr ratios.

CONCLUSION

This observation demonstrated that MFE correction using goodness of fit parameters calculated by LCModel (%SD) may improve the sensitivity of the MRS examination. Although we used a HD patient cohort to demonstrate this concept, we believe that this approach may be applicable to other hyperkinetic disorders or in non-cooperative patients. Although, absolute NAA quantification may be more sensitive than NAA/Cr ratio as it is not affected by the Cr peak fitting error, it is still affected by the NAA fitting error, which is significantly larger in patients than in normal controls. Thus, the approach proposed may also improve sensitivity of absolute MRS quantification.

Provencher, S.W., Estimation of metabolite concentrations from localized in vivo proton NMR spectra. Magn. Reson. Med. 30, 672-679, 1993.