Pilot Study of Multi-dimensional 1H MR Spectroscopy in HIV-infected Children

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Introduction

Proton MR Spectroscopy (^{1}H-MRS) enables the non-invasive measurement of cerebral metabolites that reflect the metabolic integrity and density of neurons and glial cells. Two-dimensional (2D) localized correlated spectroscopy (L-COSY) (1) was used to assess relative cerebral metabolite levels from the left frontal white matter in HIV-infected children and adolescents. In addition to N-acetyl aspartate (NAA), creatine (Cr), choline (Ch), glutamate/glutamine (Glx) and myo-inositol (mI) that are commonly reported using 1D MRS (2) , metabolites at physiological concentrations around 1mM such as, phosphoryl-choline (PCh), phosphoryl-ethanolamine (PE) and free aspartate (Asp) can also be recorded unambiguously using 2D L-COSY. The goal of the current work is to evaluate 2D L-COSY in HIV-infected pediatric patients compared to control children using a multi-coil MR phased-array assembly..

Materials and Methods

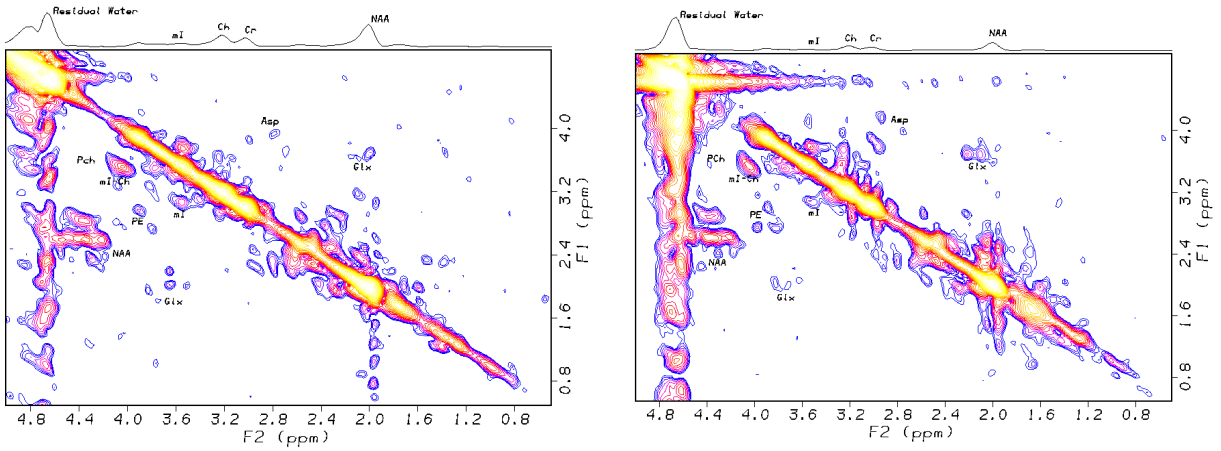
Three HIV-infected children (age range=9-11years), and four healthy children and adolescents (range=9-19 years) have been investigated. A GE 1.5T MRI/MRS scanner (General Electric Health Technologies, Waukesha, WI) was used in combination with a four-channel Nova (receive) coil. A 27 ml voxel was localized in the dorsolateral pre-frontal white matter. Global water suppression was achieved using a CHESS sequence. The parameters used were: TR=2s, TE=30ms, 96 Δt_1 and 8 averages per Δt_1. The total duration for 2D L-COSY acquisition alone was 26 minutes. The peak volumes under several diagonal and cross peaks were calculated using Felix 2000 (Accelrys, San Diego, CA). Metabolite ratios of NAA/Cr, mI/Cr, PE/Cr, Glx/Cr, Asp/Cr, mI-Ch/Cr, and Ch/Cr were computed with respect to the diagonal peak of Cr.

Results and Discussion

Shown in Fig.1 are 2D L-COSY spectra of A) an 11 year old HIV-infected patient and B) a 9 year old healthy child. The ratios (mean±SD) and the coefficient of variance for NAA, mI, PE, Glx, Asp, mI-Ch, Ch and NAA' were: (2.3± 0.16, 7%), (0.08±0.01, 14%), (0.04±0.03, 7%), (0.09±.0.01,15%), (0.08±.04, 49%), (0.13±.01, 10%), (1.39±.0.22, 15%) and (0.22±.0.02, 7%) in HIV-infected children (n=3), and (2.15± 0.1, 4%), (0.06±0.01, 10%), (0.04±0.01, 23%), (0.09±.0.01,9%), (0.08±.02, 31%), (0.11±.01, 9%), (1.4±.0.22, 16%) and (0.20±.0.03, 14%) in healthy children (n=4), respectively. NAA and NAA' were the diagonal and cross peaks of NAA. In this small sample size, there were no significant differences in NAA/Cr, PE/Cr, Glx/Cr, Asp/Cr and Ch/Cr between control subjects and HIV-infected subjects. In the HIV-infected subjects, mI/Cr and mI-Ch/Cr were elevated compared to the controls, supporting our previous 1D-MRS (2) studies where we have shown that mI and mI/Cr increased with age in HIV-infected patients but not control subjects.

Figure 1. Frontal white matter 2D L-COSY spectra of A) a 11 year old HIV-infected patient and B) a 9year old healthy child.

A) **B)**



Conclusion

We have demonstrated the feasibility of 2D-MRS in children to assess cerebral metabolites. Our preliminary results support our earlier findings with 1D-MRS, but additional studies are needed. Potentially 2D-MRS may be a sensitive technique for assessing cerebral metabolites in HIV-infected children.

References

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