Consistency of ^{1}H-MRS in the putamen of healthy adult controls over six years.

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Introduction

Magnetic Resonance Spectroscopy (MRS) is a technique that can provide specific information about the metabolites in the human brain. MRS has been used to examine a variety of brain pathologies[1], including Huntington Disease (HD)[2,3]. The TrackHD[4] and TrackON[5] studies have tracked controls and premanifest HD participants over 7 time points in total across the two studies, using a variety of measures, including MRS in the putamen[3] (an area of significant pathology in HD). In order to effectively compare to those individuals with pathology, a consistent measure of these MRS metabolites must be possible in controls. Here we compare the ^{1}H-MRS from the putamen of 15 healthy controls over 6 years (7 time points) and examine the effects of age on a group of middle aged adults, ranged ~32-61 years at the baseline visit.

Methods

A 3T MRI (Philips Healthcare) scanner was used to collect a single voxel MR spectrum on the left putamen (3.5cm x 1cm x 1.5 cm) with TR=2000ms, TE=35ms, 1024 samples and 128 averages. The spectra were analyzed using LCModel[6], and were normalized to the unsuppressed water spectral area and presented in mM units. Metabolites that could be fitted with a %SD of <30% were included[6]. Five metabolites (total NAA (tNAA), creatine (tCr), glutamate+glutamine (Glx), choline (tCho), and myo-inositol (mI)) as well as the FWHM, a reflection of the homogeneity of the spectrum, were examined. Spectra were examined from 14 controls who had 7 visits, 1 year apart, as part of the TrackHD and TrackON studies. A one-way repeated measure ANOVA was performed on each set of metabolite data, comparing metabolite concentration over time if this effect was significant a, paired student's t-test with Bonferroni-holm correction was completed for multiple timepoints, with $p<0.05$ was considered significant. The relationship between metabolite concentration and age at scan was investigated using a linear regression at each visit and p-values were corrected for multiple visits with a Bonferroni-holm correction.
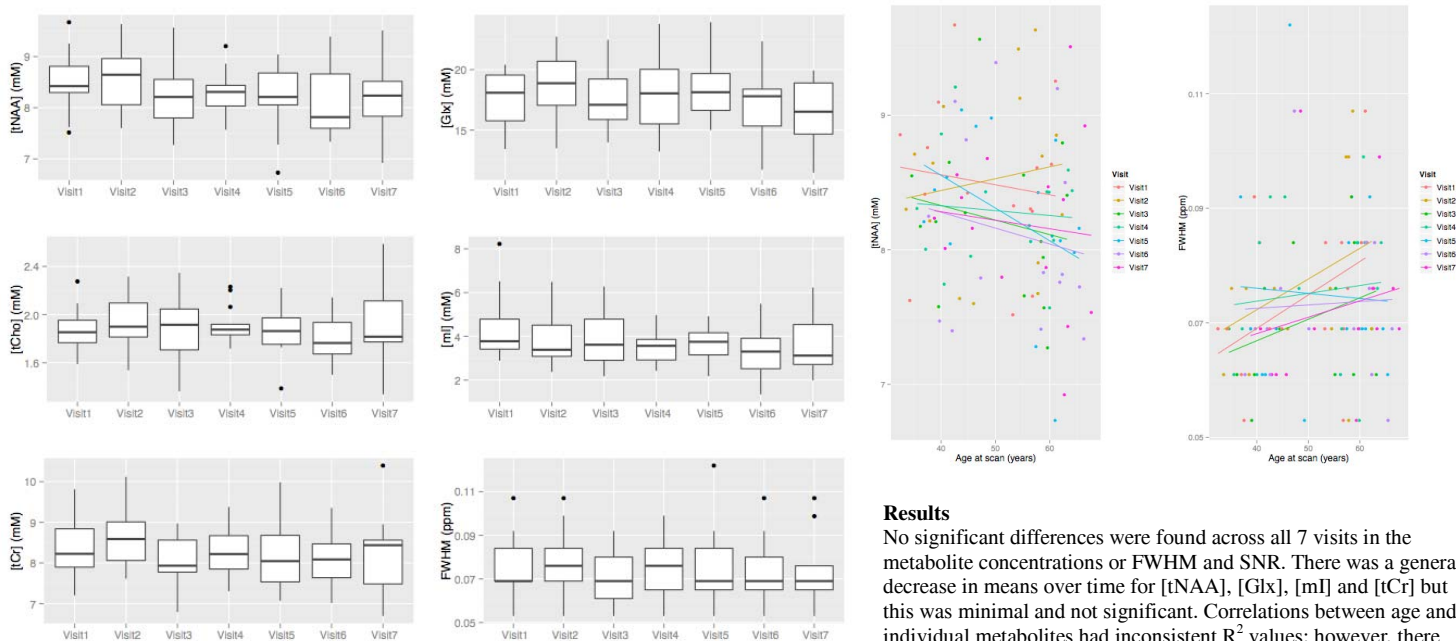
Results

No significant differences were found across all 7 visits in the metabolite concentrations or FWHM and SNR. There was a general decrease in means over time for [tNAA], [Glx], [mI] and [tCr] but this was minimal and not significant. Correlations between age and individual metabolites had inconsistent R^2 values; however, there was a tendency for greater correlations between metabolites and age at the later visits (as the subject's age increased). There were no significant correlations between age at scan and any of the measures at any visit after correction.

Discussion/Conclusions

Here we show the reliability of control scans over a 6 year period for middle aged adults over 7 visits. This is an important finding that validates the use these controls to compare to subjects with pathology, such as individuals with Huntington Disease. These findings are not surprising in light of earlier studies, where no whole brain NAA changes were found in adults over three years[7], and most aging studies showed no changes in subjects over 60 verses younger subjects[8]. However, in a meta-analysis there is some evidence that the frontal region had decrease in NAA and found some increase in the parietal lobe for choline and creatine[8]. No significant changes in any of the measures were found across 6 years in our study, this could be due to the lower age range, ie not many subjects over 60, thus age effects are minimal. There was some suggestion of decrease seen in the means of certain metabolites, they may become more pronounced as the population ages, however here we conclude that age effects on ^{1}H-MRS in middle aged controls are insignificant.

References

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