Going for glutamine: evaluation of asymmetric PRESS approaches

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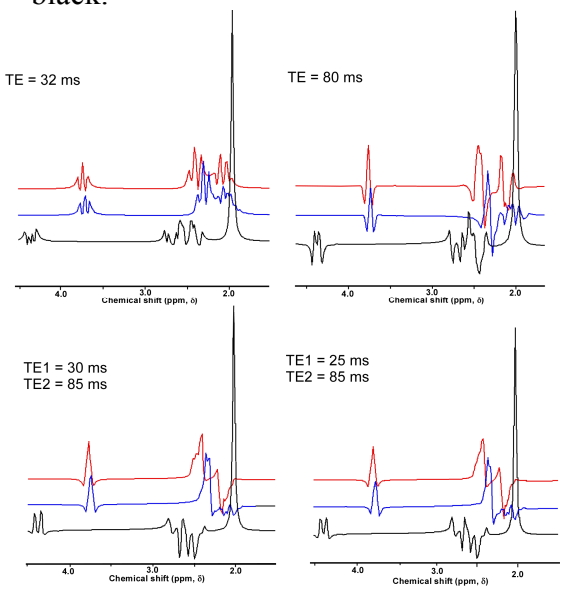
Introduction

The neurotransmitters glutamate (Glu) and GABA, and their metabolite glutamine (Gln) are highly coupled spin systems that are difficult to measure in human brain, particularly with the method of choice; fast and single-shot. Gln is particularly problematic due to its relatively low concentration and co-resonance with aspartyl signals from *N*-acetyl-aspartate (NAA). Recently, optimized timings for an asymmetric PRESS (A-PRESS) sequence were suggested for resolution of Glu from Gln [1]. Here, we test this optimized sequence at 3T against standard PRESS sequences more frequently used for Gln assessment [2], along with a variant of A-PRESS designed to minimize overlap with the NAA CH_2 moiety

Methods

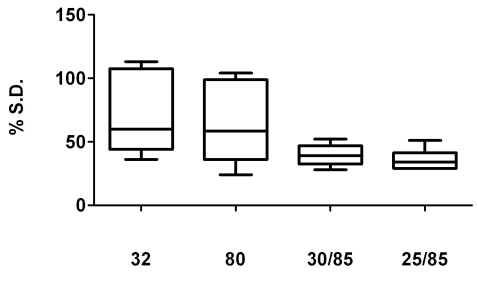
Spectra were acquired from six healthy controls (4 M 2F, range 22 - 54 y) at 3T (Philips Achieva TX) using a 32 channel head coil. A 2 x 2 x 2 cm VOI was placed in the left anterior cingulate cortex and the following four acquisitions were made: **1.** PRESS, TE = 32 ms; **2.** PRESS, TE = 80 ms, **3**. A-PRESS TE1 = 30ms, TE2 = 85 ms. **4**. A-PRESS, TE1 = 25 ms, TE2 = 85 ms. All acquisitions consisted of 2 dummy scans and 32 transients, TR = 2s. The 25/85 spectrum was also collected three times in a row without repositioning the head on two subjects. Spectra were fitted using jMRUI (v 4, build 162) using the QUEST algorithm [3] with metabolite basis sets simulated for the appropriate sequence timings using NMR SCOPE. Standard deviations estimated by jMRUI of the estimate for each metabolite (Glu, Gln, NAA) were obtained for each fit. Simulated spectra for each acquisition are shown in Fig. 1.

Fig. 1. Simulated spectra for each acquisition showing overlap of Gln and NAA. Resonances are of equal concentration. Gln = red, Glu = blue, NAA = black.



Results The standard deviations of the estimated values for Gln were significantly smaller using the A-PRESS sequence than with PRESS at TE = 32 or 80 ms (Fig. 2). The errors were smaller by a few percent with the A-PRESS variant (25/85) than with 30/85 although this difference was not statistically significant for N = 6. The reproducibility of the 25/85 acquisition was excellent, with an 8% variance in the SD estimates for Gln, 7% for Glu and 1% for NAA.

Fig. 2. Standard deviations of fits for Gln. Box and whisker (10-90%)



Discussion

Asymmetric PRESS is a reliable single-shot method for improving the precision of Gln measurement at 3T. Further improvements can be made using 25/85 ms timings instead of 30/85.

References

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