SELECTIVE REDUCTION OF NAA IN MEDIAL TEMPORAL LOBE IN MILD COGNITIVE IMPAIRMENT

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Introduction:

Previous MR spectroscopic imaging (MRSI) studies showed that AD is associated with a characteristic regional pattern of diminished NAA concentration, primarily involving medial temporal and parietal lobe gray matter, while white matter and frontal lobe gray matter NAA remains normal [1]. Because NAA is a marker of neuronal integrity, a selective reduction of NAA in medial temporal and parietal lobes could therefore be a more specific sign of incipient AD pathology than MRI measured brain atrophy. In this study we sought to test whether NAA reductions are greater than reductions of hippocampal or cortical volumes in elderly subjects with cognitive impairment but no dementia (CIND), who are at increased risk for AD.

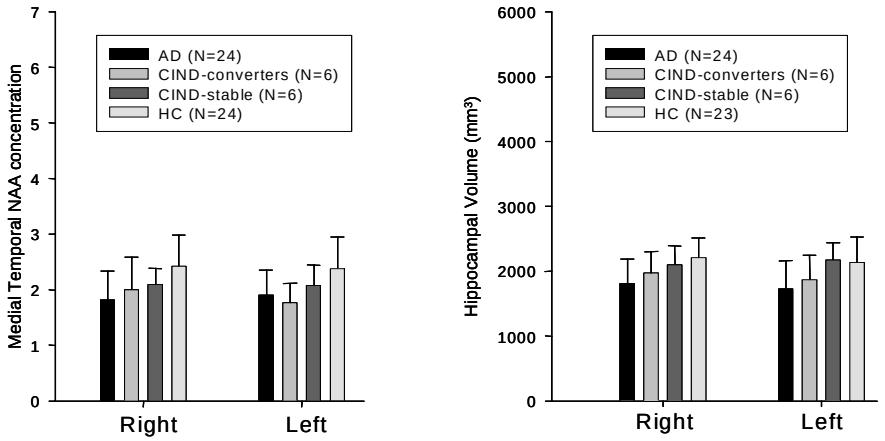
Methods:

Seventeen CIND subjects, as defined by a clinical dementia rating scale (CDR) of 0.5 were compared to 24 age-matched AD patients (CDR >= 1.0) and 24 age-matched cognitively normal (CN) subjects (CDR = 0.0). Furthermore, 12 of those CIND subjects had a clinical follow-up over a period of about 2 years with six subjects converting to dementia and the rest remaining stable. Acquisition and processing of MRSI data (TR/TE=1800/135ms) have been previously described in detail [2].

Results:

CIND had about 20% less NAA concentration in the medial temporal lobe ($p = 0.005$) compared to controls. Moreover, NAA losses in this region were larger in CIND subjects, who converted to dementia than in CIND subjects, who remained stable. In contrast to NAA, differences of hippocampal volume between CIND and CN were not significant ($p>0.2$). Figure 1 depicts differences of NAA concentrations in medial temporal among the groups. Decreased NAA in medial temporal lobe correlated stronger [r=0.59] with increasing memory deficits on the delayed list recall test than hippocampal volume loss [r=0.29]. Compared to medical temporal lobe, NAA of cortical regions was less reduced in CIND.

Figure 1: Variations of NAA of medial temporal lobe (left) and hippocampal volume (right) among the different groups



Conclusions:

Selective reduction of NAA in medial temporal lobe is consistent with several previous MR spectroscopy studies of dementia [1,3]. Moreover, there were no significant differences in NAA concentrations between AD and CIND in this brain region, suggesting diminished neuronal integrity is similar in CIND and AD. In addition, NAA reductions in the medial temporal lobe correlated stronger with memory deficits than hippocampal volume, suggesting that NAA measurements are a better predictor for memory deficits than volume measurements. Taken together, this underscores the functional significance of reduced NAA concentration in the brains of CIND subjects and its potential value for detection of early AD pathology.

References:

[1] Schuff et al., Neurology. 2002; 26;58(6):928-35.
[2] Schuff et al., Magn Reson Med. 2001; 45(5):899-907
[3] Block et al., Arch Neurol. 2002; 59(5):828-34