Magnetic resonance spectroscopy demonstrates neuronal loss and altered glutamatergic neurotransmission in Alzheimer’s disease

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Background: The role of the anterior cingulate cortex (ACC) is involved in the default mode network during resting state, and is dysfunctional in ageing and Alzheimer’s disease (AD). We used magnetic resonance spectroscopy (MRS) to study the biochemical and metabolite profile in patients with AD, and compared with cognitive-normal healthy controls (HC) with no cognitive complaints.

Methods: In a cross-sectional study, 12 age-matched HC and 11 AD patients underwent 1H-MRS using ACC as the region of interest. We measured choline (Cho), creatine (Cr), N-acetyl-aspartate (NAA), myo-inositol (mI), and glutamate/glutamine complex (Glx), and quantified them using internal water as reference.

Results: Compared to HC, AD patients had significantly lower Cho (AD, 2.09 ± 0.52 mM; HC, 3.51 ± 0.78 mM; P<0.001), NAA (AD, 7.80 ± 2.52 mM; HC, 15.27 ± 2.90 mM; P<0.001), and Glx (AD, 6.74 ± 1.90 mM; HC, 17.45 ± 4.17 mM; P<0.001). However, Cr (AD, 18.05 ± 2.52 mM; HC, 16.66 ± 1.84 mM; P=0.185) and mI (AD, 12.00 ± 4.10 mM; HC, 8.82 ± 3.84 mM; P=0.089) showed no significant differences.

Conclusion: Our findings are consistent with current literature supporting the evidence of neuronal loss and altered glutamatergic neurotransmission in AD. MRS may be sensitive for studies of early AD, mild cognitive impairment, and subjective cognitive decline.