The correlation between the MRS brain metabolites value and neuropsychological tests among patients with Alzheimer's disease: A pilot study

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ABSTRACT

Introduction: Alzheimer's disease (AD) is becoming one of the most concerning types of illness at the present time. This is because of the increase in the number of occurrences due to the increase in the number of elderly populations worldwide. Special attention is being given to manage the disease as it affects the quality of life of those affected. Increase in the number of deaths resulting from the disease has also been reported. Tremendous effort is being taken even from the past few decades to be able to diagnose the disease at an earlier stage for better management. Magnetic resonance spectroscopy (MRS) is a non-invasive in-vivo imaging method for measuring brain metabolites. Alterations in specific metabolite concentrations in the brain may serve as a surrogate marker for the diagnosis of AD. They can be applied to diagnosis, prognosis prediction and, or even monitoring treatment response. Despite having many advantages MRS is not being widely used clinically therefore, the effectiveness is not clear. Hence, this study aims to prove a standardized MRS technique and validation of the regional and temporal changes of the metabolites in the brain of those with AD compared to HC and to explore the relationship between brain metabolites and neuropsychological test scores. **Materials and Methods:** A cross-sectional study was conducted to compare the changes in the brain metabolites between AD and healthy control (HC) subjects in Klang Valley. The study was conducted using MRS and structural MRI imaging, for the duration of 2 years. The scans were performed using a 3.0 Tesla Siemens Magnetom PRISMA machine. The structural MRI images acquired is a T1-weighted magnetization-prepared rapid gradient-echo (MPRAGE) sequence and for the MRS single voxel spectroscopy technique, PRESS sequence were used. Both water-suppressed and water non-suppressed data were acquired. The placement of the 1H-MRS voxel was done covering the right and left hemispheric posterior cingulate cortex (PCC). We utilized SPM Matlab Osprey software as a computational approach in neuroimaging to extract significant quantitative brain metabolites alterations among subjects from both groups. Besides, each of the subjects underwent neuropsychological tests which consisted of Montreal Cognitive Assessment (MoCA) and Mini-Mental State Examination prior to the MRI scan. **Results:** Decrease in N-Acetyl-Aspartate (NAA) and elevation in Myo-Inositol (mI) level were detected in AD in comparison with HC group. Significant difference is seen in gender and educational level of the subjects in both the groups. Lastly, metabolites such as Glutamate (Glu), Glutamine (Gln) and γ-Aminobutyric Acid and Glutathione (GABA) have positive correlations with neuropsychological test scores ($p<0.05$). **Conclusion:** MRS has the potential of being a biomarker for AD detection as it clearly shows alteration in brain metabolites in comparison to the healthy populations. Besides, it also supports the neuropsychological tests to further confirm the diagnosis.