Developing an Algorithm To Analyze Structural Characteristics of Alzheimer's Disease in Different Stages of Mild Cognitive Impairment and Validate White Matter Atrophy as an Early Predictor of Mild Cognitive Impairment (A Novel Second Year Study)

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Alzheimer’s disease (AD) is the sixth leading cause of death in the world, and has no method for prevention or effective treatment. A promising method of predicting it is through analyzing the structural MRIs of mild cognitive impairment (MCI) patients. Diagnosing MCI can be subjective, but using an automated method can lead to an earlier diagnosis of AD, higher quality of life, and lower healthcare costs. The purpose of this experiment was to determine the validity of white matter atrophy as a characteristic of MCI and Alzheimer’s disease and use that to develop an algorithm to differentiate between cognitively normal patients, patients with Alzheimer’s disease, and patients with differing severities of MCI. The researcher considered five factors: age, sex, hippocampal, white matter, and total brain volume. White matter atrophy was found to be a significant structural characteristic of Alzheimer’s disease in comparison with hippocampal and total brain atrophy. The algorithm established risk factors based on volume of the hippocampal formation, white matter structures, and total brain for patients of specific age groups and sexes. Analysis of scans showed that destruction of white matter structures is more prevalent before hippocampal atrophy and eventually, total brain atrophy, which supports evidence for white matter atrophy being a reliable indicator of MCI. The algorithm was trained with 1,100 pieces of data and then tested with 110, yielding an accuracy of 91%. With further testing, this may be a promising tool for differentiating between cognitively normal, eMCI, MCI, lMCI, and AD patients.

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