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Establishing a new screening system for MCI and AD with mental rotation tasks that evaluate visuospatial function

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Abstract

Background: The mental rotation task is well-known for the assessment of visuospatial function; however, it has not been used for screening of dementia patients (Shepard RN, Metzler J, Science 1971).

Objective: To create a simple screening test for patients with mild cognitive impairment (MCI) and Alzheimer's disease (AD) by focusing on non-amnestic symptoms.

Methods: In this study, we enrolled age-matched healthy controls (age 75.3 ± 6.8), patients with MCI (76.5 ± 5.5) and AD (78.2 ± 5.0) participated. They carried out mental rotation tasks targeting geometric graphics or alphabetical characters with three rotating angles (0° , 90° and 180°) and indicated the correct answer. Response accuracy and reaction time were recorded along with their eye movements using an eye tracker. To quantify their visual processing strategy, the run count ratio (RC ratio) was calculated by dividing the mean number of fixations in incorrect answers by that in correct answers (Archibald NK et al., Brain 2013).

Results: AD patients showed lower accuracy and longer reaction time compared with controls. They also showed a significantly greater number of fixation and smaller saccade amplitude than controls, while no significant difference was shown in fixation duration. The RC ratio was higher for AD, followed by MCI and control groups. By setting the cut-off value to 0.47 in the 180° rotating angle task, we could differentiate MCI patients from controls with a probability of 80.0%.

Conclusions: We established a new screening system for dementia patients due to AD by evaluating visuospatial function. The RC ratio during a mental rotation task is useful for discriminating MCI patients due to AD from controls.