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Featured Article

The validity of the Memory Alteration Test and the Test Your Memory test for community-based identification of amnestic mild cognitive impairment

Seline Ozer[a,b,*], Krist Noonan[c], Melanie Burke[b], John Young[a], Sally Barber[a], Anne Forster[a], Roy Jones[c]

[a]*Academic Unit of Elderly Care and Rehabilitation, University of Leeds, Bradford Institute for Health Research, Bradford Teaching Hospitals NHS Foundation Trust, Bradford, United Kingdom*

[b]*School of Psychology, Faculty of Medicine and Health, University of Leeds, Leeds, United Kingdom*

[c]*Research Institute for the Care of Older People (RICE), Bath, United Kingdom*

Abstract

Introduction: This study investigated the validity of two brief cognitive tests (Memory Alteration Test [M@T] and Test Your Memory [TYM] test) for identifying people with aMCI in the community.
Methods: Older people were invited to participate by their general practitioner practice. Eligible participants were assessed for aMCI using an operationalized approach to the Petersen criteria and the M@T and TYM.
Results: Both tests demonstrated significant ability in discriminating between people with aMCI and controls (AUC = 0.91 for M@T and 0.80 for TYM [$P < .001$ for both]). M@T performed with higher sensitivity than TYM (85% vs. 63%) and similar specificity (84% vs. 87%). Both tests demonstrated moderate test-retest reliability ($\kappa = \sim 0.5$) and took <10 minutes to administer.
Discussion: M@T and TYM are quick to administer. M@T demonstrated higher diagnostic test accuracy than TYM and could provide an efficient method for identifying aMCI in clinical and research settings.

Keywords: Dementia; Alzheimer's disease; Mild cognitive impairment; Validity; Reliability; Neuropsychological assessment; Diagnostic test accuracy

1. Introduction

There has been a growing clinical and research interest in the early identification of people at risk of developing dementia. Mild cognitive impairment (MCI) has emerged as a term to capture the predementia phase of cognitive dysfunction [1] and is defined as "cognitive decline greater than that expected for an individual's age and education level but that does not interfere notably with activities of daily life" [2]. The amnestic form of MCI (aMCI), where the predominant symptom is memory impairment, is associated with elevated rates of conversion to Alzheimer's disease (AD) [3]. It has been suggested that it may be more effective to target interventions at people in this predementia phase of AD, before the progressive disease is established [4].

Amnestic MCI is however largely unrecognized in primary care as its diagnosis depends on complex neuropsychological assessment methods not usually available in this setting. There is a need for simple, quick, and sensitive cognitive tests that will provide a more efficient way of identifying people with aMCI. These would provide a useful resource to busy primary health care staff who are encouraged, as stated in UK national guidance, to refer people

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*Corresponding author. Tel.: +44 1274 383908; Fax: +44 1274 382766.

E-mail address: seline.ozer@bthft.nhs.uk

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who show signs of MCI for further assessment by memory assessment services to aid early identification of dementia [5]. They could also be applied by researchers to find suitable participants for enrollment into studies of candidate interventions targeted at this early stage of cognitive decline.

A recent systematic review found that over 40 brief cognitive tests have been developed and tested to identify people with aMCI [6]. Several of these cognitive tests demonstrated promising diagnostic test accuracy, although most studies were found to be at a high risk of bias due to the method of participant selection used. Most studies selected patients with known aMCI from memory clinics and compared their performance on the test under evaluation with an opportunistically recruited group of people assumed to have no cognitive impairment. This exposed the studies to risk of unblinding of the patient assessment process and potentially exaggerated diagnostic accuracy [7,8]. The present study aimed to address this limitation by assessing the validity of two brief cognitive tests in a cohort of participants all recruited from the community, without prior knowledge of their cognitive status, thereby reducing the risk of bias in the assessment process.

The Memory Alteration Test (M@T) and the Test Your Memory (TYM) test were selected for investigation in this study. The developers of M@T, which is a brief, interviewer-administered memory task, reported it to have very high sensitivity (96%) and high specificity (70%–79%) for discriminating between people with aMCI and healthy controls [9,10]. The developers of TYM reported that it had very high sensitivity (93%) and high specificity (86%) for discriminating between people with and without mild Alzheimer's disease [11]. A subsequent study using a Japanese version of the test highlighted its potential for use as a screening tool for aMCI, reporting high sensitivity (76%) and specificity (74%) [12]. The TYM has the added advantage of being self-administered and requiring minimal supervision.

The aim of the present study was to evaluate the effectiveness of the M@T and TYM for identifying people with aMCI by investigating: (1) their sensitivity and specificity in detecting aMCI in a community-based population in comparison with the widely used standard for diagnosing aMCI based on the Petersen criteria [13]; (2) their test-retest reliability performance; and, (3) their clinical utility, assessed in terms of administration time and completion rates.

2. Methods

2.1. Recruitment

Participants were recruited from nine Bradford, UK, general practitioner practices (total registered patient population of 85,870). Their primary care health records were first screened to identify people who (1) were aged 70 years and older; (2) were not resident in a care or nursing home; (3) did not have dementia; (4) did not have current depression; (5) did not have history of stroke within the previous 3 months; (6) were not receiving palliative care. Study information flyers were posted to these identified people. The flyer asked further eligibility questions and those who responded and met the following criteria (or required further clarification) were contacted by telephone: (1) self-reported difficulty with their memory; (2) spoke English; (3) had attended school for at least eight years; (4) had an informant available to answer some of the study questions. Additionally, 100 people who did not self-report memory difficulties were invited to take part. Further checks were carried out by phone to ensure that the person was medically stable and could travel to our research offices. The eligible volunteers subsequently gave informed written consent to participate and enrolled onto the study during a visit to their home. The study was approved by the Yorkshire and The Humber National Research Ethics Service Committee (ref: 12/YH/0207).

2.2. Assessment

We developed a standardized protocol of neuropsychological tests to objectively assess for cognitive impairment, and a classification consistent with aMCI was determined according to the Petersen criteria [13]. The tests encompassed the cognitive domains of: memory (California Verbal Learning Test (CVLT), 2nd Edition [14]), executive function and attention (Brixton Spatial Anticipation Test [15] & Trail Making Test Parts A & B [16]), visuospatial function (visual object and space perception, spatial subset [17], and Clock Drawing Test [16]) and language (Graded Naming Test [18] & Pyramids and Palm Trees test [19]). Activities of daily living (ADL) performance were assessed using the informant-administered Bristol Activities of Daily Living Scale [20]. In addition, the National Adult Reading Test [21] was administered to provide an indication of premorbid verbal IQ. Mood was also assessed, initially via two depression screening questions [22,23] included in the study information flyer. Later, these were removed from the flyer and a more detailed assessment of mood was completed using the Geriatric Depression Scale-short form (GDS) [24], once the participant had been enrolled onto the study. The GDS was administered to the majority (93%) of participants. As low mood is known to impact on memory performance, all those participants who scored $\geq$6 on the GDS were classified as having "low mood" and were excluded from further analyses.

Participants who demonstrated impairment in memory (defined as CVLT short delay and long delay free recall $\geq$ 1.5 standard deviations below mean of published norms) and no impairment in ADL were classified as aMCI. Both single-domain (memory impairment only) and multi-domain (memory impairment and one or more other cognitive domain impairment) aMCI participants were included.

The other possible classification categories after the neurocognitive assessment process were (1) nonamnestic MCI