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Original Study

Baseline Association of Motoric Cognitive Risk Syndrome With Sustained Attention, Memory, and Global Cognition

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A B S T R A C T

Objectives: Slow gait has been shown to be a good predictor of declining cognitive function in healthy older adults. Motoric cognitive risk (MCR) syndrome is a new construct incorporating slow gait and subjective cognitive complaints in individuals without dementia who have preserved activities of daily living. This analysis investigated the prevalence of MCR and factors associated with MCR in a nationally representative population. In addition, cross-sectional associations between MCR and cognitive domains, an relationship yet to be fully elucidated in literature, was investigated.

Measurements: Participants completed a comprehensive neuropsychological assessment and gait analysis at a health assessment center. Logistic regression was employed to examine associated health factors. Composite scores reflecting global cognition, memory, sustained attention, executive function, and processing speed were constructed using neuropsychological test scores. Associations between MCR and these composites were quantified using multivariate generalized linear modelling. All analyses were weighted to be nationally representative.

Setting: Community-dwelling adults in The Irish Longitudinal Study on Aging (TILDA) completed an interview and a center-based health assessment.

Participants: Participants aged 60 years and over (n = 2151, age; mean: 67.84 years, range: 60-93) were included. Participants with a Mini-Mental State Examination score of below 24, a diagnosis of serious memory impairment, Parkinson disease, dementia, or Alzheimer disease were excluded.

Results: MCR prevalence was estimated at 2.56% (95% confidence interval 1.97, 3.31). Significant risk factors for MCR were antidepressant use [odds ratio (OR) 4.46, $P < .001$], self-reported poor vision (OR 4.92, $P < .05$), and obesity (OR 2.29, $P < .01$). Individuals with MCR performed worse on tests that assess memory (B: −0.58, $P < .001$), global cognition (B: −0.42, $P < .001$), and sustained attention (B: −0.34, $P < .05$) with robust adjustment made for confounding demographic and health variables.

Conclusions: MCR is characterized by strong negative associations with global cognition, attention, and memory. This may be indicative of the underlying pathology of MCR. The effect of antidepressant use on MCR is novel and may represent an important consideration in future studies.

Identifying markers of cognitive impairment as early as possible is paramount to implement potential prevention strategies and inform patient management. Gait is a complex process found to incorporate neural substrates of executive function, processing speed, and cognitive flexibility.[1,2] A simple gait assessment, as opposed to lengthy neuropsychological testing, has the potential to quickly screen for cognitive decline.

Motoric cognitive risk (MCR) syndrome is characterized by slow gait and subjective cognitive complaints in individuals who are free of

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dementia and unrestricted in their activities of daily living.[3] The prevalence of MCR has been reported to be between 1.7% and 12% in several large cohorts.[4–7] A number of risk factors for MCR have been identified including obesity, physical inactivity, cardiovascular disease, depressive symptoms, and falls.[4,5] In longitudinal analysis, MCR has been found to be a predictor of vascular dementia and Alzheimer disease.[3,6]

Imaging studies have been carried out to further elucidate the underlying neural substrates of MCR syndromes. There is evidence to support underlying pathology of both vascular dementia and Alzheimer disease. Magnetic resonance imaging assessment of white matter hyperintensities in MCR demonstrate evidence of frontal lobe lacunar infarcts, suggestive of a vascular dementia type pathology.[8] Computed tomography studies of brain volume in patients with MCR suggest a more generalized global atrophy of gray matter.[9]

Regarding neuropsychological function, differences between groups with MCR and groups without MCR have been examined in several studies.[3,6,9–12] In most, there is limited adjustment for important confounding health factors. In other studies, sample sizes are low.[3,9–11] The largest studies that compare cognitive function between participants with MCR and without MCR adjust solely for demographic characteristics.[3,6,10] It has been reported that MCR is associated with decreased global cognition, attention, and language subscores obtained using the Repeatable Battery for the Assessment of Neuropsychological Status neuropsychological battery.[10] Further studies have indicated a potential executive dysfunction in individuals with MCR.[6,11] Sekhon et al[12] further stratified examination of cognitive function in patients with MCR by mild cognitive impairment (MCI) status. It was shown that those with both MCI and MCR performed poorly on tasks of executive function, yet cogntive performance in the total group with MCR remained heterogenous.

Assessment of cognitive function in MCR syndrome may further clarify which neural substrates are affected in this group and provide indicators as to the underlying pathology. The comprehensive neuropsychological assessment within the Irish Longitudinal Study on Aging is well positioned to explore this question. To further our understanding of MCR, the aim of this study was 3-fold: (1) to estimate the prevalence of MCR in an aging Irish population; (2) to uncover the associated factors for MCR; and (3) to determine the associations between MCR and multiple cognitive domains with robust adjustment for confounding factors.

Methods

The Irish Longitudinal Study on Aging (TILDA) is a nationally representative prospective cohort study of community-dwelling adults age 50 years and over residing in Ireland. It is designed using the Irish Geodirectory (a listing of all residential addresses in the Republic of Ireland) as a sampling frame. A random, clustered sample of addresses was chosen using the RANSAM system with residents aged ≥50 years and their spouses/partners (of any age) invited to participate in the study.[13] Data was collected via computer-aided personal interviewing, self-completed questionnaire, and a center- or home-based physical health assessment. Exclusion criteria for this analysis was a self-reported diagnosis of Alzheimer disease (n = 7), dementia (n = 7), Parkinson disease (n = 35), and serious memory impairment (n = 29), a Mini-Mental State Examination (MMSE) score of less than 24 (n = 192) or aged less than 60 years (n = 3600). As gait and cognitive measures were obtained during the center-based health assessment, participants who did not attend the center were also excluded (n = 1979), giving a sample size of 2151 participants. Data from wave 1 was employed, for which collection began in 2009.

Gait Assessment

Gait was measured using a 4.88 m electronic walkway (GAITRite; CIR Systems, Inc, Havertown, PA). Participants were specifically instructed to walk at their usual pace. They completed 2 passes of the walkway, beginning 2.5 m before and finishing 2 m after the walkway to allow for acceleration and deceleration. Mean gait speed was calculated per 5-year age group for each sex and normalized for height. Participants used walking aids during the assessment if required.

MCR Syndrome

Participants were classified with MCR if they met the following 4 criteria: (1) Subjective memory complaints: a response of "fair" or "poor" to "How would you rate your memory?" rather than excellent, very good, or good. This is consistent with the approach used when analyzing MCR in the Health and Retirement Study.[14] (2) Slow gait speed: defined as 1 standard deviation (SD) below the age group and sex appropriate mean gait speed calculated previously.[15] (3) Preserved activities of daily living: No difficulty reported when dressing, walking across a room, bathing or showering, eating, getting in or out of bed, and using the toilet.[16] (4) Absence of dementia diagnosis: see exclusion criteria above.

Cognitive Function

The TILDA health assessment included an extensive battery of neuropsychological measures. The MMSE and the Montreal Cognitive Assessment questionnaires are 2 measures of global cognition, spanning several domains, which are used in clinical practice.[17,18] Visual memory was assessed using a picture recall and recognition task (The Picture Memory test from the Cambridge Examination for Mental Disorders of the Elderly, Revised).[19] Semantic memory was assessed in both immediate and delayed formats using a 10-word recall task. The Color Trails Task (CTT) comprised of 2 trials and is a language independent version of the Trail Making Test.[20] Trial 1 involves drawing a line to connect 25 numbers. Trial 2 involves drawing a line connecting numbered circles of alternate color. The difference in duration between trial 2 and trial 1 (ie, color trail time delta) requires cognitive flexibility and adjusts for differences in upper extremity motor speed and visual scanning. During the word fluency test, participants were asked to name as many animals as possible in 1 minute. The visual reasoning task consisted of 3 boxes filled with objects and 1 empty box, requiring participants to identify the missing object to complete the sequence. The test included 6 sequences and is considered a measure of executive function. The choice reaction time (CRT) test used a computer-based program to assess concentration and processing speed. Cognitive reaction time is defined as the time taken to release a button in response to a stimulus. The Sustained Attention to Response Test (SART)[21] requires an individual to focus on an activity and process stimuli for a prolonged period. Specific measures include the mean response time and SD (variability) of response time, in addition to errors of commission and omission (reflecting vigilance and inattention).

The tests that contribute to each cognitive domain were examined using composites as follows: global cognition (Montreal Cognitive Assessment and MMSE), memory (immediate and delayed recall, picture recall, and picture recognition), processing speed (CTT trial 1 time and mean cognitive response time on CRT), executive function (word fluency, CTT trial time delta, visual reasoning, and CTT trial 2 time), and sustained attention (SART mean response time and SD, errors of commission and omission). Composite scores were formed by averaging z-scores of each contributory test; these composite scores were included in all statistical analysis.

Covariates

Demographic variables (age, sex, highest educational level) were obtained. Height and weight were measures of obesity defined as a body mass index of >30kg/m^2. Physical activity was assessed using the International Physical Activity Questionnaire short form. A 3-level