The characteristic of cognitive function in Type 2 diabetes mellitus

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ABSTRACT

Aim: To identify characteristics of neuropsychological function among elderly individuals with Type 2 diabetes mellitus with mild cognitive impairment (T2DM-MCI) and evaluate domain-specific effects of T2DM on cognition.

Methods: This was a cross-sectional study conducted in Tianjin, China. MCI subjects ($n = 246$) and controls were identified in elderly individuals with diabetes, and groups were matched in a 1:1 ratio for sex, age and educational level. Cognitive function was assessed using WAIS-III (block design, digit span), Trail Making Test A, Trail Making Test B, WMS-III (word list learning, logical memory), verbal fluency and MMSE. We used multivariable logistic regression to find diabetic factors associated with MCI.

Results: The mean MMSE score was 22.73 ± 2.32 in subjects with T2DM-MCI, versus 26.71 ± 2.43 in subjects cognitive normal ($P < 0.001$). Executive and visuospatial functions were more impaired in individuals with T2DM-MCI than in those without, as assessed using block design ($P < 0.001$), digit span test ($P < 0.001$), and Trails B ($P < 0.001$). For memory, subjects with T2DM-MCI did worse than those cognitive normal on the word learning list delayed recall ($P = 0.015$). Diabetic-related factors such as longer duration of T2DM, higher HbA1c, insulin treatment was associated with a lower level of cognitive functioning using MMSE, block design, delayed recall and Trails B test.

Conclusions: T2DM should be considered a risk factor for MCI. This risk may be associated with duration of diabetes, use of glucose-lowering medications, degree of glucose control. To decrease risk of MCI, it is important to monitor glucose control and adjust medications appropriately in elderly patients.

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1. Introduction

Cognition is a collective term for a range of higher brain functions, including memory, perception, language, and reasoning; impaired cognitive function could be a first sign for developing different forms of dementia. Mild cognitive impairment (MCI) can occur several years before a clinical diagnosis of dementia and increases risk of developing dementia at an early stage [1].

Epidemiologic studies suggest that MCI may be one of the many complications experienced by elderly persons with Type 2 diabetes mellitus (T2DM) [2–5]; T2DM doubles risk of dementia [6]; moreover, numerous studies report T2DM is associated with poor performance on various cognitive tests, especially among elderly individuals. However, the underlying cause for this association is not clear. Thus, the relationship of MCI with T2DM has been the subject of much speculation in recent years.

A number of studies have found that certain aspects of cognitive function are impaired in elderly patients with T2DM compared to age-matched non-diabetic controls [2–5,7–12]. However, a number of methodological problems, including sample size and selection of neuropsychological tests, may account for differences in findings across studies examining cognition and T2DM [13,14].

In view of this, by addressing MCI in patients with T2DM, we assessed cognitive function in people with T2DM-MCI, described the pattern of cognitive impairment in T2DM, sought diabetic factors that might be associated with cognitive function, and elucidated possible mediating mechanisms potentially underlying this association.

2. Research design and methods

2.1. Study population and recruitment

In March 2010, a cross-sectional study was conducted among community-dwelling residents aged ≥65 years. Using random cluster sampling, six geographically convenient communities with a high proportion of elderly residents who are all native Chinese speakers were selected from the entire city of Tianjin, China. An eligible person was aged ≥65 years in 2010 and self-designated as an ethnic Han. This recruitment procedure yielded an almost representative sample for the respective communities. Details about the recruitment information have been published elsewhere.

Of the original 8608 elderly subjects, 395 participants were excluded: (1) those with difficulties in daily living activities (n = 199), (2) those with inability to communicate with the interviewer (n = 41), (3) those with cerebral trauma and intoxication (n = 63), and (4) those refusing to complete the tests (n = 92). After exclusions, 8213 elderly Chinese were eligible for investigation and included in the study. Each participant underwent an in-person interview of general health and function at the time of study entry, followed by a standard assessment, including medical history, physical and neurological examination, and a neuropsychological test battery. Fig. 1 presents an overview of the study design and sampling procedures.

In compliance with the Helsinki declaration, all subjects were informed of the concept of the study and signed an informed consent prior to their participation. The study was approved by the Ethics Committee of the Tianjin Health Service (protocol number: TMUhMEC201220).
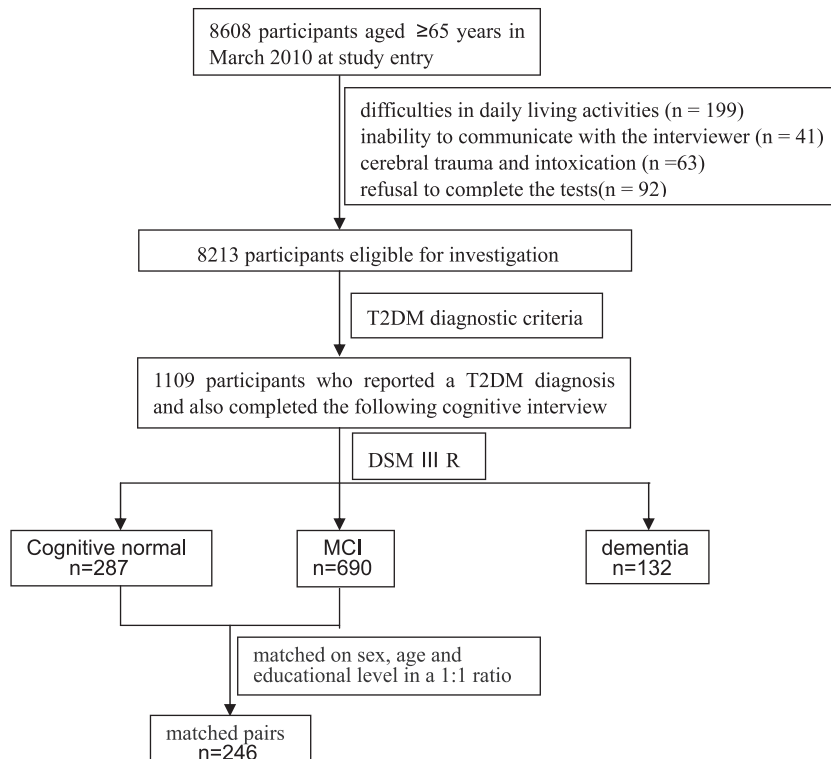

Fig. 1 – Flow diagram of the study population in the project.