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Research Article

Development and Clinical Validity of a Mild Vascular Cognitive Impairment Assessment Tool for Korean Stroke Patients

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SUMMARY

Purpose: The present study was conducted to develop a mild vascular cognitive impairment (MVCI) assessment tool for patients with stroke and to examine its validity, reliability, and clinical adequacy.
Methods: Items of this tool were developed based on previously verified cognitive assessment tools. Face, content, and criterion (concurrent) validities, optimal cut-off score for differentiation of MVCI and normal cognitive function, clinical adequacy, internal consistency, and inter-rater reliability of the assessment tool were determined in 60 stroke patients at a university hospital located in Incheon, South Korea.
Results: The devised MVCI assessment tool contains 20 items which were designed to assess seven cognitive domains: orientation, memory, language, attention, reasoning/abstraction, visuospatial perception, and executive function/problem solving. Content, face, and construct validities were well supported. Clinical adequacy testing revealed that the overall probability of correctly discriminating MVCI using the MVCI assessment tool for stroke was 90.0%, which was statistically significant. Furthermore, a score of 23 was found to be the optimal cut-off score for MVCI. Internal consistency and inter-rater reliability were also well supported.
Conclusions: The findings of this study indicate that the developed MVCI assessment tool for stroke could serve as a clinically useful tool for detecting MVCI and for properly assessing degree of cognitive impairment in stroke patients.

Introduction

Vascular cognitive impairment is a spectrum of cognitive impairments caused by various diseases, such as hypertension, diabetes, arteriosclerosis, transient ischemic attack, and stroke [1]. Stroke is one of the most common causes of vascular cognitive impairment [2]. The term cognitive impairment covers a wide variety of conditions ranging from the mildest form of cognitive impairment to overt dementia [1,3–5]. Poststroke cognitive impairment may lead to dementia (vascular dementia), but it often exhibits mild deficiencies in cognitive function (mild vascular cognitive impairment; MVCI) [6], which is referred to as "vascular cognitive impairment, no dementia". Despite great differences between studies, the highest incidence rate of 64.0% for MVCI among stroke survivors was reported by Jin, Di Legge, Ostbye, Feightner, and Hachinski [7]. Few studies have been conducted on the MVCI incidence rate in Korea. Only one study reported an incidence rate of 39.0% (n = 156) for mild cognitive impairment among 396 Korean stroke patients [8].

According to Wentzel et al [9], approximately half of patients with MVCI develop dementia within 5 years of stroke. The common cognitive domains associated with MVCI in stroke patients are short-term memory (31.0%), long-term memory (23.0%), visuospatial ability (37.0%), executive functions (25.0%), and language (14.0%) [10]. In addition, MVCI following stroke has been shown to be significantly associated with early death and decrease in quality of life for patients and their families [6].

The assessment of MVCI is important because the early detection of cognitive impairment may facilitate intervention targeting the prevention of dementia in stroke patients [11,12]. In addition, proper assessment can provide precise information to stroke patients and their families, and enable the development of effective cognitive rehabilitation plans that improve outcomes and quality of

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life. Therefore, development of a well-validated cognitive assessment tool is important for the establishment of nursing care and rehabilitation plans for stroke patients.

Backgrounds

It has been consistently reported that MVCI occurs frequently in patients with stroke [13,14]. According to Nys, van Zandvoort, de Kort, Jansen, de Haan, and Kappelled [15], a high proportion of stroke survivors develop MVCI within 3 months of stroke, especially if the cerebral cortex is involved (74.0%). Patients suffering from vascular dementia often present with cognitive decline and memory impairment severe enough to interfere with daily activities [1]. On the other hand, MVCI is characterized by slight cognitive impairments in only a few cognitive domains and does not significantly impact daily functioning [16–18]. Nevertheless, MVCI may lead to dependence on others for daily activities, adversely affects patient quality of life, and increases family burden [6].

Of the cognitive domains, executive functioning and visual perception are most commonly associated with MVCI, and short-term and long-term memory, attention, and language are also frequently involved [15]. Furthermore, it has been reported that the severities of deficits in executive functioning, language, verbal memory, and abstract reasoning are more pronounced following left than right cortical stroke [15].

Investigators have consistently asserted no consensus has been reached regarding the definition of mild cognitive impairment, and that the boundary between normal cognitive function and mild cognitive impairment has not been clearly defined [18,19]. However, distinguishing between pathological mild cognitive impairment and normal cognitive function is important when determining therapeutic options [18].

The Mini-Mental State Examination (MMSE) is the test most widely applied to screen cognitive impairment in clinics [20]. However, although the MMSE has been shown to be useful for screening Alzheimer's type dementia, it is inadequate for evaluating mild cognitive impairment because of its insensitivity to visuospatial and executive functional deficits [21–23].

The Cambridge Examination for Mental Disorders of the Elderly (CAMCOG) was originally designed to diagnose primary degenerative dementia. This test has the advantage that it covers a broader range of cognitive functions than other tests do [24], and has been shown to be a more accurate screening tool than the MMSE, especially for elderly stroke patients [24]. However, little is known about the diagnostic value of the CAMCOG for MVCI screening.

The Telephone Interviews for Cognitive Status (TICS) was initially developed to assess cognitive function in elderly patients with Alzheimer's type dementia. The TICS is a brief test (takes 5–10 minutes) and known to be sensitive and specific [25]. However, this test was considered unsuitable for screening MVCI following stroke because it covers only orientation, memory, attention, and language domains of cognitive function [25].

The Montreal Cognitive Assessment (MoCA) tool, which was recently introduced, was developed to detect mild cognitive impairment, and has been shown to be more sensitive for detecting mild cognitive impairment than the MMSE [11,26]. The MoCA includes several cognitive domains that have been reported to be most commonly associated with MVCI following stroke in clinical research studies, and several studies have confirmed its high sensitivity and specificity and determined optimal cut-off values by receiver operating characteristic (ROC) curve analysis [27]). Furthermore, the MoCA has been translated into 36 languages including Korean and Chinese, and is now the most popular cognitive screening tool for detecting mild cognitive impairment [28]. The greatest advantage of the MoCA is its ability to discriminate between patients with mild cognitive impairment and patients with dementia or healthy controls [29]. In addition, the MoCA is a brief, simple tool that can be applied within 10 minutes and places more emphasis on visuo-motor-speed and executive abilities than other tools do [30].

Based on a review of related literature, we considered the MoCA to be the most suitable measure for screening mild type cognitive impairment. However, the MoCA was unlikely to be used for long-term follow-up examinations and repeated measures because it includes many items that require evaluations of animal pictures or naming cards in a face-to-face manner. In addition, the MoCA does not contain items that assess problem-solving ability, one of the most common cognitive domains associated with MVCI in stroke patients [31]. Accordingly, we recognized the need for MVCI assessment tool which addresses major cognitive domains associated with stroke and can be administered using diverse approaches including face-to-face and telephone-based administrations.

Study purpose

The present study was conducted to develop and verify a MVCI assessment tool for Korean stroke patients. The specific study aims were (1) to review other cognitive assessment tools and develop qualified items sensitive to MVCI that are capable of identifying the specific cognitive domains involved and applicable using different approaches (face-to-face and telephone interviews) for long-term follow-up examinations; (2) to evaluate the content and criterion validities of the MVCI assessment tool for stroke; (3) to conduct ROC curve analysis to examine construct validity and clinical adequacy by determining an optimal cut-off for differentiation of MVCI and normal cognitive function, and (4) to evaluate the reliability (internal and inter-rater reliability) of the MVCI assessment tool for stroke.

Methods

Study design

The present study adopted a nonexperimental, cross-sectional correlation design to develop a MVCI assessment tool for stroke and examine its validity and reliability.

Item development procedure

Developing a brief, simple MVCI assessment tool that can be administered in different ways was the prime goal of the present study. As a preliminary step, we reviewed the literature regarding cognitive impairment after stroke. In particular, an extensive literature review on previously verified cognitive assessment tools able to assess diverse cognitive domains was performed. Finally four cognitive assessment tools of fair quality were identified with simple and brief features (completed within 5–10 minutes without professional aid). These were MMSE (Korean version), CAMCOG, TICS, and MoCA (Korean version).

The MMSE uses simple tasks to assess a number of cognitive domains: orientation, memory, attention, language, and complex demands. Orientation tasks measure sense of current year, month, date, day of the week, and season. Memory tasks assess ability to repeat the names of three objects, which are spoken by an examiner at a rate of one per second, immediately (registered memory) and after a set time (delayed memory). Attention tasks measure the ability to count by subtracting 7 from 100. Language tasks assess the ability to name an object, repeat a given phrase/sentence, follow a three-stage command as written, read and repeat a given