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The current situation on vascular cognitive impairment after ischemic stroke in Changsha

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ABSTRACT

The objectives of the study were to explore the prevalence and effects of vascular cognitive impairment (VCI) among ischemic stroke patients and to provide a basis for prevention and treatment strategies. A stratified cluster random sampling method was performed, and 689 ischemic stroke patients (over 40 years of age) were enrolled. All of the patients had received a neuropsychological assessment battery to assess cognitive function and self-designed questionnaires to collect relevant information. According to the cognitive status, the patients were divided into two groups, a case group and a control group. The caregivers of the patients were given a questionnaire concerning the awareness of and attitudes toward VCI. In this study, we determined that the prevalence of VCI was 41.8%. Aging, paraventricular white matter lesion (WML), macroangiopathy, high levels of alcohol, a lack of hobbies, and excessive sleep were risk factors for vascular cognitive impairment no dementia (VCIND). A high level of education, manual-work, low level of alcohol use, regular health checks, a vegetable-based diet, and more fruit and milk were protective factors for VCIND. Living alone, hyperlipidemia, transient ischemic attack, a family history of stroke, and brain atrophy were risk factors of vascular dementia (VD). A high educational level, a vegetable-based diet, and tea were protective factors for VD. The general public awareness of VCI was found to be insufficient, and there was a prejudice toward and lack of funding for the care of VCI patients. The prevalence of VCI is high in ischemic stroke patients, and there are different impact factors at different stages. Despite the high prevalence of VCI, the general public awareness is limited. Appropriate prevention measures should be developed to reduce the prevalence of VCI.

1. Introduction

Stroke is the third leading cause of death and a major cause of disability and mortality (Barba et al., 2000) that poses the greatest global threat to the elderly. Among stroke survivors, 3/4 of the patients had a physical disorder (Barba et al., 2000), and 2/3 had cognitive impairment (Jin, Di Legge, Ostbye, Feightner, & Hachinski, 2006), which may result in a quantifiable decrease in the quality of life (Haley, Roth, Kissela, Perkins, & Howard, 2011) and a financial burden for the patient's family and society (Germain et al., 2009; Nagai & Kario, 2011). According to the health statistics yearbook, prevention and treatment of cerebrovascular disease costs nearly $30 billion a year in our country (China, 2004). In the USA, the average health care cost per stroke patient was $33,740 (Ramos-Estebanez, Moral-Arce, Rojo, Gonzalez-Macias, & Hernandez, 2012). Because of the high prevalence, serious complications and major economic burden of strokes, effective strategies for the prevention of and treatment for strokes should be established.

VCI is preventable and curable if diagnosed sufficiently early (Moorhouse & Rockwood, 2008). As the major type of VCI, post-stroke cognitive impairment might be preventable and curable at an early stage (Moorhouse & Rockwood, 2008). A study on the epidemic status and impact factors of post-stroke cognitive impairment can help in the early identification and diagnosis of cognitive impairment. Timely and effective treatment is beneficial in avoiding or delaying disease progression, preventing cognitive impairment, improving the quality of life of patients, and alleviating the health care burden on the patient's family and society. Increasing the knowledge base for VCI has important practical significance and profound social significance and is an important strategy for building a healthy aging society. Considering the high prevalence of VCI in stroke patients, early screening for VCI in this group can decrease the risk of negatively affecting the

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labor force and necessitating additional financial investment for health care for these patients. Several studies have shown that cognitive impairment is more likely to occur following an ischemic stroke than a hemorrhagic stroke (Barker-Collo et al., 2012; Erkinjuntti et al., 2000; van Straaten, Scheltens, & Barkhof, 2004). An epidemiological study of VCI in ischemic stroke patients is practical and feasible.

2. Methods

2.1. Participants

This study was conducted in Changsha city. The sample size was calculated to determine a prevalence of 36.7% (Qun et al., 2008) with a 10% margin of error for prevalence and a 5% α error. The calculated sample size of 663 was increased to 762 to account for a dropout rate of 15%.

A stratified cluster random sampling method was performed. People of similar social status tend to cluster together. The first level of stratification was comprised of six districts of Changsha city, and the primary sampling unit was the community. The communities were randomly selected within each sector. Two of the districts were over sampled to ensure adequate numbers of subjects with ischemic stroke. The final sample consisted of 381 ischemic stroke patients in four communities from the over sampled districts and 381 ischemic stroke patients in four communities from the remaining four districts. In each community, the individuals were selected randomly. The participants were required to have resided in the selected community for at least five years to ensure that all the participants had an established lifestyle related to the area of residence.

The inclusion criteria were as follows: (1) age $\geq$40 years old; (2) a history of ischemic stroke, with brain computed tomography (CT) scanning or magnetic resonance imaging (MRI) and 3 months from the latest stroke attack; and (3) the research participant must have been conscious and in stable condition and a volunteer subject who had signed an informed consent personally or by a guardian.

The exclusion criteria were as follows: (1) hemorrhagic cerebrovascular disease (e.g., cerebral hemorrhage or subarachnoid hemorrhage); (2) other neurological diseases that would potentially affect cognitive function (e.g., Parkinson's disease); (3) a history of head injury, cancer or mental illness; (4) alcohol or drug abuse or exposure to toxic chemicals (e.g., CO, pesticides); (5) severe aphasia, apraxia, visual impairment or hearing impairment precluding a reliable assessment of cognitive function, and (6) a history of mental disorders (e.g., anxiety or depression).

2.2. Data collection

All the subjects were interviewed with unified questionnaires according to a standardized technique by a specifically trained professional during September 2008 to September 2011. The data collected included the following elements: (1) demographic characteristics, including age, gender, educational level, occupation, marital status and living status; (2) medical history, including hypertension, diabetes mellitus, hyperlipidemia, coronary heart disease, transient ischemic attack (TIA), cervical spondylosis, and family history of stroke; (3) clinical manifestations of stroke, including memory loss, aconuresis, gait abnormality, pseudobulbar palsy, and fall; (4) behavior and life style; (5) dietary habits; (6) social support, including subjective support, objective support and social support utilization; (7) awareness of and attitude toward VCI, including the following aspects: knowledge about VCI, awareness of early symptoms and treatment, degree of patient and caregiver cooperation, and economic affordability.

2.3. Cognitive assessment

All of the subjects had been given the following neuropsychological assessments: the Montreal Cognitive Assessment-Changsha version (Qiuyun et al., 2012) (MoCA-CS), the Mini-Mental State Examination (MMSE), the Frontal Assessment Battery-Changsha version (Dubois, Slachevsky, Litvan, & Pillon, 2000) (FAB-CS), the logical memory section of the revised Wechsler Memory Scale, Chinese version (WMS-RC), the Clinical Dementia Rating (CDR), the Activity of Daily Living Scale (ADL), the Functional Activities Questionnaire (FAQ), the Center for Epidemiological Survey Depression Scale (CES-D), and the social support rating scale (SSRS).

The diagnosis criteria of diagnosis were as follows: VD was diagnosed according to the National Institute of Neurological Disorders and Stroke (NINDS) and the Association Internationale pour la Recherche et L'Enseignement en Neurosciences (AIREN) clinical criteria (Lopez et al., 1994); and VCIND was diagnosed according to expert consensus on VCI (Jia et al., 2010).

2.4. Neuroimaging characteristics

An MRI brain scan was performed on all the participants. If the patient had an ischemic focus, the following radiological data were collected for the presence of the infarct, the subtype, number, size, and location (deep versus superficial location). The stroke size was defined as: (a) large, if the infarction involved more than one-half of the cerebral hemisphere; (b) small, if the infarction was >10 mm in diameter, but less than one-half of the cerebral hemisphere; and (c) lacunar, if the infarction was <10 mm in diameter. According to the MRI characteristics and stroke symptoms, the patients can be divided into macroangiopathy and microangiopathy types (Grau et al., 2001).

Macroangiopathy is defined as the presence of an occlusion or stenosis with a $\geq$50% diameter reduction of a brain-supplying artery corresponding to clinical symptoms and with a location and morphology typical of atherosclerosis on Doppler ultrasound or angiography.

Microangiopathy is defined as the presence of one of the traditional lacunar syndromes, infarction(s) <1.5 cm in diameter or a normal CT/MRI examination and the absence of acute cerebral cortical dysfunction.

The areas of signal hyperintensity were classified as periventricular hyperintensity (PVH) or deep white matter (DWM) (Fazekas, Chawluk, Alavi, Hurtig, & Zimmerman, 1987). PVH was graded as absence (grade 0), "caps" or a pencil-thin lining (grade 1), smooth "halo" (grade 2), or irregular PVH extending into the DWM (grade 3). DWM areas were rated as absence (grade 0), punctate foci (grade 1), beginning confluence of foci (grade 2), and large confluent areas (grade 3).

Brain atrophy was measured using an automatic method for segmenting the brain from the head in MRI scans (Atkins & Mackiewich, 1998).

2.5. Procedures

The survey was conducted from September 2008 to September 2011 and was divided into the following two stages: the first stage consisted of data collection and primary screening of cognitive impairment, and the participants with MMSE scores $\geq$29 and MoCA-CS scores $\geq$28 were diagnosed as cognitively normal; the second stage consisted of further testing of the suspected cognitive impairment patients whose MMSE scores 29 or MoCA-CS scores 28.

2.6. Data analysis

All the analyses were performed using the SPSS 17.0 for Windows software package (SPSS, Inc., Chicago, IL). The relative