Current Status and Influencing Factors of Mild Cognitive Impairment in Young and Middle-aged Hypertensive Inpatients: A Postprint

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Date: 2022-08-12T00:00:00+00:00

Abstract

Background: The incidence of mild cognitive dysfunction (MCI) is relatively high in hypertensive patients; however, current research on MCI in hypertensive patients both domestically and internationally has primarily focused on elderly populations, with a paucity of studies investigating the occurrence and related influencing factors in young and middle-aged hypertensive patients.

Objective: To investigate the prevalence of mild cognitive dysfunction and analyze its influencing factors among young and middle-aged hospitalized hypertensive patients.

Methods: A convenience sampling method was employed to select 213 young and middle-aged hypertensive patients hospitalized in a tertiary Grade A hospital in Harbin from May to December 2021. Participants were surveyed using a general information questionnaire, the Montreal Cognitive Assessment Scale, and the Type D Personality Scale. Logistic regression analysis was utilized to identify influencing factors of mild cognitive dysfunction in young and middle-aged hospitalized hypertensive patients.

Results: The prevalence of mild cognitive dysfunction in young and middle-aged hospitalized hypertensive patients was 37.9%. Logistic regression analysis revealed that age, BMI, education level, smoking history, hypertension grade, Type D personality, TG, and HDL-C were the main influencing factors ($P<0.05$).

Conclusion: The prevalence of mild cognitive dysfunction is relatively high among young and middle-aged hospitalized hypertensive patients. Patients with advanced age, low education level, Type D personality, elevated TG, and decreased HDL-C are at increased risk for mild cognitive dysfunction. Healthcare professionals should conduct early assessment and risk factor screening for mild

cognitive dysfunction in young and middle-aged hypertensive patients to identify high-risk populations and implement effective preventive measures.

Full Text

Preamble

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Funding: National Natural Science Foundation of China (72004045); Basic Research Project of Fundamental Research Funds for Provincial Universities in Heilongjiang (JFYQPY202103); 2020 Harbin Medical University "Curriculum Ideology and Politics" Special Project (SZQ202020)

Abstract

Background: Mild cognitive impairment (MCI) is a common complication in hypertensive individuals, but current studies on MCI in hypertensive patients have focused primarily on elderly populations. Research on the incidence and influencing factors of MCI among young and middle-aged hypertensive patients remains scarce.

Objective: To investigate the current status of MCI in young and middle-aged hospitalized patients with hypertension and to analyze its influencing factors.

Methods: Using convenience sampling, 213 young and middle-aged hypertensive patients hospitalized in a tertiary hospital in Harbin from May to December 2021 were surveyed using a general information questionnaire, the Montreal Cognitive Assessment (MoCA), and the Type D Personality Scale (DS14). Logistic regression analysis was used to identify influencing factors of MCI in this population.

Results: The incidence of MCI among young and middle-aged hospitalized hypertensive patients was 37.9%. Logistic regression analysis revealed that age, BMI, education level, smoking history, hypertension grade, Type D personality, triglycerides (TG), and high-density lipoprotein cholesterol (HDL-C) were significant influencing factors ($P < 0.05$).

Conclusion: Young and middle-aged hospitalized hypertensive patients exhibit a high incidence of MCI. Patients with advanced age, low education level, Type D personality, high TG, and low HDL-C are particularly vulnerable. Healthcare professionals should conduct early screening and assessment of MCI and its risk factors in young and middle-aged hypertensive patients to identify high-risk groups and implement effective prevention and control measures.

Keywords: hypertension; mild cognitive impairment; young and middle-aged; Type D personality

Introduction

Hypertension is one of the most prevalent chronic non-communicable diseases worldwide. With lifestyle changes, the prevalence of hypertension in China has increased significantly in recent years. According to the *China Cardiovascular Health and Disease Report 2018*, there are currently 245 million hypertensive patients in China, of which 165 million are young and middle-aged individuals, accounting for 67.5% of the total hypertensive population [1,2]. As a "silent killer," hypertension not only damages target organs such as the heart, brain, and kidneys but also impairs cognitive function [3,4]. Based on the degree of cognitive impairment, it can be classified into mild cognitive impairment (MCI) and dementia. The MCI stage, often referred to as the "prodromal phase of dementia," represents a transitional state between normal cognition and dementia and is potentially reversible, making it the optimal "window period" for reducing dementia risk [5].

Previous studies have confirmed that hypertension is closely associated with MCI. However, current research on MCI in hypertensive patients has predominantly focused on elderly populations, with limited attention to the incidence and related influencing factors among young and middle-aged hypertensive patients. Moreover, most previous studies have targeted community-based hypertensive patients, lacking investigation into influencing factors among hospitalized hypertensive patients [6,7]. Therefore, this study aims to investigate the current status and related influencing factors of MCI in young and middle-aged hospitalized hypertensive patients, providing a scientific basis for establishing risk prediction models and developing early intervention strategies to better guide clinical practice.

1.1 Study Subjects

Using convenience sampling, young and middle-aged hypertensive patients hospitalized in the Department of Cardiology and Hypertension Center of a tertiary hospital in Harbin from May to December 2021 were selected as study subjects. Inclusion criteria were: (1) meeting the diagnostic criteria of the 2018 *Chinese*

Guidelines for the Prevention and Treatment of Hypertension (blood pressure measured on three separate occasions with systolic pressure $\geq$ 140 mmHg and/or diastolic pressure $\geq$ 90 mmHg, diagnosed by clinicians with relevant examinations, and secondary hypertension excluded); and (2) age 18–65 years (based on the definition of young and middle-aged individuals in the *Chinese Expert Consensus on Hypertension Management in Young and Middle-aged Populations* [8]).

Exclusion criteria included: (1) presence of other diseases that may cause cognitive impairment, such as traumatic brain injury, Parkinson's disease, Alzheimer's disease, vascular dementia, or central nervous system demyelination; (2) inability to cooperate with cognitive assessment due to hearing impairment or communication barriers; and (3) severe dysfunction of other vital organs (heart, brain, lungs, kidneys) or confirmed malignant tumors. A total of 213 patients were included, all of whom provided informed consent. This study was approved by the hospital ethics committee.

1.2.1 Survey Instruments

(1) General Information Questionnaire: Developed by the researchers based on literature review and expert consultation, including demographic data (age, gender, education level, marital status, family monthly income, etc.) and disease characteristics (smoking history, drinking history, body mass index [BMI], hypertension grade, disease duration, etc.). Smoking history was defined as smoking more than 4 cigarettes per week in the past 6 months. Drinking history was defined as daily alcohol intake $\geq$ 25 g for men and $\geq$ 15 g for women. BMI was calculated as weight/height^2. According to WHO classification: underweight (BMI $<$ 18.5), normal (18.5 $\leq$ BMI $<$ 25), overweight and obese (BMI $\geq$ 25). Hypertension grading: Grade 1 (systolic 140–159 mmHg, diastolic 90–99 mmHg), Grade 2 (systolic 160–179 mmHg, diastolic 100–109 mmHg), Grade 3 (systolic $\geq$ 180 mmHg, diastolic $\geq$ 110 mmHg).

(2) Montreal Cognitive Assessment (MoCA) Beijing Version: Originally developed by Nasreddine et al., MoCA is an internationally recognized rapid screening tool for MCI [9]. The Chinese version was revised by the Chinese PLA General Hospital and includes seven domains: visuospatial and executive function (5 points), naming (3 points), attention and calculation (6 points), language (3 points), abstraction (2 points), delayed recall (5 points), and orientation (6 points). Total scores range from 0 to 30, with scores below 26 indicating MCI. To correct for education bias, 1 point was added for individuals with $\leq$ 12 years of education. Higher scores indicate better cognitive function. The scale has good reliability and validity with a Cronbach's α coefficient of 0.82 [10].

(3) Type D Personality Scale (DS14): Originally developed by Dutch scholar Denollet for screening Type D personality [11]. The Chinese version

was revised by Tilburg University, Chinese University of Hong Kong, and the Institute of Psychology, Chinese Academy of Sciences. It comprises two dimensions: negative affect (7 items) and social inhibition (7 items), totaling 14 items scored on a 5-point Likert scale (0–4). Type D personality is identified when scores on both dimensions are ≥ 10. The scale has good reliability and validity with a Cronbach' s α coefficient of 0.838 [12].

1.2.2 Data Collection Methods

Eligible patients were surveyed within 48 hours of admission. All investigators received collective training and used standardized instructions to explain the study content and precautions to patients, ensuring anonymity and confidentiality. With patients' consent, one-on-one assessments were conducted, with researchers completing questionnaires on-site. Each assessment took approximately 20 minutes. Physiological indicators were collected the morning after admission after patients rested in a supine position for 30 minutes.

1.2.3 Statistical Methods

All raw data were double-entered to ensure accuracy. SPSS 26.0 was used for data analysis. Categorical data were described using frequencies and percentages, with between-group comparisons using chi-square test or Mann-Whitney U test. Continuous data were described as mean $\pm$ standard deviation, with between-group comparisons using t-test. Variables with statistical significance in univariate analysis were included in a binary logistic regression model to analyze influencing factors of MCI in young and middle-aged hypertensive patients. $P < 0.05$ was considered statistically significant.

2.1 Current Status of MCI in Young and Middle-aged Hospitalized Hypertensive Patients

A total of 231 patients were initially surveyed. After excluding 2 duplicate patients (readmitted during the study period), 3 patients with corrected diagnosis of secondary hypertension, 8 patients with missing laboratory data, and 5 patients who refused to complete the assessment, 213 patients were finally included. The sample comprised 113 males (53.05%) and 100 females (46.95%), with ages ranging from 22 to 65 years (mean 49.23 $\pm$ 11.25 years). Based on MoCA scores and after adjusting for education level, 80 patients (37.56%) had MCI and 133 (62.44%) had normal cognitive function (N-MCI).

2.2 Univariate Analysis of MCI in Young and Middle-aged Hospitalized Hypertensive Patients

Univariate analysis revealed statistically significant differences between the MCI and N-MCI groups in age, BMI, occupation, education level, residence location, family per capita monthly income, smoking history, hypertension grade, Type D personality, TG, and HDL-C ($P < 0.05$). No significant differences were found in gender, marital status, living arrangement, drinking history, disease duration, fasting blood glucose, total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), or white blood cell count (WBC) ($P > 0.05$). See Table 1 .

2.3 Logistic Regression Analysis of MCI Influencing Factors

With MCI occurrence as the dependent variable, 10 variables with statistical significance in univariate analysis were entered as independent variables into a binary logistic regression analysis. Continuous variables were entered as original values, and other variable assignments are shown in Table 2 . Results indicated that age, BMI, education level, smoking history, hypertension grade, Type D personality, TG, and HDL-C were influencing factors of MCI in young and middle-aged hospitalized hypertensive patients ($P < 0.05$). See Table 3 .

Discussion

3.1 The High Incidence of MCI in Young and Middle-aged Hospitalized Hypertensive Patients Warrants Attention

This study found that the incidence of MCI in young and middle-aged hospitalized hypertensive patients was 37.56%, similar to that reported in young and middle-aged diabetic inpatients (37.9%) [13] but substantially higher than in community-based hypertensive populations (18.2%–30.7%) [14,15]. This elevated rate may be attributed to the fact that our study population comprised hospitalized patients in a tertiary hospital, most of whom were admitted due to poorly controlled blood pressure or comorbid cardiovascular diseases and complications. Previous research has confirmed that untreated hypertension and poor blood pressure control are major contributors to cognitive decline and can accelerate the progression from MCI to dementia [6,7]. Therefore, early identification and prevention of MCI in this population are urgently needed.

Furthermore, a recent longitudinal cohort study published in *Hypertension* involving 7,063 hypertensive patients demonstrated that hypertension, regardless of onset age or duration, may lead to cognitive decline, with patients diagnosed before age 55 showing more rapid memory deterioration [16]. MCI symptoms in hypertensive patients are often insidious and frequently overlooked by families and society, with many patients seeking medical attention only when obvious

dementia symptoms appear in old age [17], thereby missing the optimal intervention "window period." This underscores the importance of cognitive assessment and risk factor screening in young and middle-aged hypertensive patients to identify high-risk groups early and shift the focus of prevention forward to avoid dementia in later life.

3.2.1 Older Age, Low Education Level, and Smoking History Increase MCI Risk

This study identified older age, low education level, and smoking history as susceptible factors for MCI in hypertensive patients, consistent with previous findings [18,19]. Aging leads to vascular degeneration and amyloid-β protein deposition, which exacerbates white matter damage caused by hypertension [17], resulting in cognitive impairment. The cognitive reserve hypothesis posits that individuals with greater experiential resources maintain better cognitive function and can tolerate higher levels of brain pathology before clinical symptoms emerge [20]. Education level is the most typical indicator of cognitive reserve; hypertensive patients with higher education can continuously update their cognition, strengthening neural connections and enhancing tolerance to cellular structural loss or functional abnormalities, thereby mitigating progressive cognitive decline [21].

Our results also showed that smoking history is an independent risk factor for MCI in young and middle-aged hypertensive patients [OR = 2.373, 95% CI (1.123, 5.016)]. Nicotine and carbon monoxide in cigarettes can directly cause white matter atrophy, affecting cognitive function [19]. Regarding alcohol consumption, while previous studies have found a U-shaped relationship between drinking history and MCI—where moderate drinking may reduce MCI risk [22]—our study only assessed the presence of drinking history without evaluating frequency or amount, which may explain why we found no association.

3.2.2 Higher Hypertension Grade and BMI Increase MCI Likelihood

This study demonstrated that hypertension grade and BMI are important influencing factors for MCI in young and middle-aged hospitalized hypertensive patients. Previous research has shown a significant positive correlation between hypertension grade, disease duration, and cognitive function level, with higher grades and longer duration associated with poorer cognitive function [23]. Elevated blood pressure damages the structural and functional integrity of cerebral microcirculation, leading to insufficient perfusion in major brain functional areas and impairing attention and executive function [23]. Additionally, high blood pressure disrupts the blood-brain barrier, triggering secondary neuroinflammatory responses and amyloid pathology that cause neural damage [24].

However, we found no relationship between disease duration and MCI, possibly because our study population comprised young and middle-aged patients with relatively short mean disease duration (6.63 ± 5.31 years). Regression analysis

also identified BMI as a significant influencing factor, with 50% of MCI patients being overweight or obese. Previous studies have confirmed that the prevalence of overweight and obesity is significantly higher in young and middle-aged hypertensive patients than in elderly patients [2], highlighting the need for lifestyle interventions in this population to improve BMI and prevent or delay cognitive decline.

3.2.3 High TG and Low HDL-C Levels Increase MCI Probability

Our findings indicate that young and middle-aged hypertensive patients with high TG and low HDL-C levels face greater MCI risk. International studies have shown that individuals with hyperlipidemia have higher susceptibility to cognitive impairment, with high TG levels closely associated with lower overall cognitive scores and visual working memory scores, while low HDL-C levels correlate with reduced overall cognitive function and poor executive function [25,26]. Chinese scholar Lou Fangli' s investigation of 9,391 middle-aged and elderly individuals also confirmed that HDL-C is an important predictor of cognitive dysfunction in this population [27].

Lipids are essential for cellular metabolism, and brain cells particularly require cholesterol esters for normal structural and functional operation. Chronic hypertriglyceridemia thickens the cerebral arterial intima, reduces cerebrovascular endothelial function and cerebral blood flow, slows brain metabolism, and consequently impairs cognitive function. Additionally, high TG levels promote amyloid-β peptide deposition, accelerating cognitive decline [28]. HDL-C, known as the "scavenger" of blood vessels, exerts anti-atherosclerotic effects through antioxidant and anti-apoptotic pathways, thereby protecting blood vessels and reducing MCI risk [29].

3.2.4 Type D Personality Increases MCI Risk

As a chronic and persistent stress factor, Type D personality plays an important role in the development and progression of hypertension [30] and has been included as a routine screening marker for psychological risk of cardiovascular disease in the European Guidelines on cardiovascular disease prevention [31]. Our study found that Type D personality is an independent risk factor for MCI in young and middle-aged hypertensive patients [OR = 2.253, 95% CI (1.074, 4.725)].

Increasingly, studies have identified personality traits as potential predictors of cognitive decline, demonstrating that personality can influence cognitive deterioration through stress responses, health behaviors, and cognitive stimulation activities [32]. Unterrainer et al. found that cardiovascular disease patients with Type D personality exhibited significant declines in specific cognitive functions compared to non-Type D patients [33]. Type D personality, also known as "distressed" personality, tends to experience chronic stress characterized by negative affectivity and social inhibition [34,35]. This chronic stress activates

the hypothalamic-pituitary-adrenal (HPA) axis, stimulating increased release of cortisol and catecholamines, which triggers autoimmune reactions in vascular endothelial cells and causes endothelial dysfunction [36]. Simultaneously, HPA axis overactivation stimulates chronic inflammatory responses, manifested by elevated levels of inflammatory factors such as CRP, IL-6, and TNF-α, which can affect synaptic plasticity and inhibit neurite outgrowth [37,38], ultimately leading to cognitive decline.

Conclusion

This study revealed that the incidence of MCI in young and middle-aged hospitalized hypertensive patients is 37.9%, warranting attention from clinical healthcare professionals. Age, BMI, education level, smoking history, hypertension grade, Type D personality, TG, and HDL-C are major influencing factors. However, due to time and geographical limitations, this study only included patients from a single region in a cross-sectional design, which may limit sample representativeness and precludes establishing causal relationships between influencing factors and MCI. Future multi-center cohort studies are needed to explore predictive factors for MCI development in this population, providing a scientific basis for early identification and prevention.

Author Contributions: YE Qingfang contributed to study design, data collection, and manuscript writing and revision; WANG Yini and LIN Pin were responsible for study design, data management, and quality control; LI Ling and LIU Guojie participated in data collection, data analysis, and manuscript review; LI Qiujie oversaw overall study design, quality control, and took final responsibility for the manuscript.

Conflict of Interest: The authors declare no conflict of interest.

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Note: Figure translations are in progress. See original paper for figures.