Postprint of a Meta-Analysis on the Prevalence and Trends of Mild Cognitive Impairment in Elderly Hypertensive Patients in China

Authors: Wang Biqing, Zhang Ping, Yang Hongxia, Wang Qian, Ju Chunxiao, Zhao Junnan, Mei Jun, Zhang Ying, Xu Fengqin, Xu Fengqin

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Abstract

Background: Elderly hypertension complicated with cognitive impairment has become one of the global public health issues. Systematically evaluating the prevalence of mild cognitive impairment among elderly hypertensive patients in China can provide data references for the prevention and treatment of cognitive damage in this population. Objective: To systematically evaluate the prevalence of mild cognitive impairment among elderly hypertensive patients in China using Meta-analysis, and to further explore the development trend of the prevalence. Methods: Systematically searched Chinese and English databases including CNKI, Wanfang Data Knowledge Service Platform, VIP, Chinese Biomedical Literature Database, PubMed, Cochrane Library, Embase, and Web of Science from inception to February 2024. NoteExpress software was used for literature management and screening. The Agency for Healthcare Research and Quality (AHRQ) cross-sectional study evaluation criteria were adopted for literature quality assessment. Two researchers independently screened literature, extracted data, and evaluated the quality of included studies. Meta-analysis and subgroup analysis were performed using StataMP 14.0 software. Results: Systematically analyzed 27 cross-sectional studies from 2008–2023, involving 57,461 elderly hypertensive patients with 11,812 cases. Through Meta-analysis using a random-effects model, the overall prevalence rate was 21.3% (95% CI = 18.4%-24.2%, P < 0.001). The included studies covered 11 provinces (autonomous regions, municipalities) in China, with significant differences in prevalence among provinces (autonomous regions, municipalities) and geographical regions. The prevalence of mild cognitive impairment in elderly hypertension showed a fluctuating upward trend from 2008–2023, with overall prevalence exceeding 10%. Subgroup analysis results showed: the prevalence of mild cognitive impairment among rural elderly hypertensive patients in China was 33.6% (95% CI = 6.4%-60.7%, P < 0.001), while urban patients had a prevalence of 21.8% (95% CI

= 18.1%-25.4%, P < 0.001). The prevalence in North China (14.0%, 95% CI = 9.3%-18.7%, P < 0.001) was lower than other regions. The MCI prevalence assessed by combined MMSE+MoCA application was 25.9% (95% CI = 15.8%-36.0%), single MoCA assessment was 21.4% (95% CI = 18.5%-24.4%), and single MMSE assessment was 17.9% (95% CI = 13.9%-21.9%). Conclusion: The overall prevalence of MCI among elderly hypertensive patients in China is relatively high, with significant differences between provinces and between urban and rural areas, showing a fluctuating upward trend over time. There are also certain differences in MCI detection rates among different assessment tools. Due to the number of included studies and heterogeneity, the conclusions need to be confirmed by further high-quality research.

Full Text

Meta-Analysis of Prevalence and Development Trend of Mild Cognitive Impairment in Elderly Hypertensive Patients in China

WANG Biqing[1],[2], ZHANG Ping[2],[3], YANG Hongxia[2], WANG Qian[2], JU Chunxiao[2], ZHAO Junnan[2], MEI Jun[2], ZHANG Ying[2], XU Fengqin[2],[3]*

[1]Graduate School, Beijing University of Chinese Medicine, Beijing 100029, China
[2]Department of Geriatrics II, Xiyuan Hospital, China Academy of Chinese Medical Sciences, Beijing 100091, China
[3]Key Laboratory of Disease and Syndrome Prevention and Treatment of Vascular Aging, Xiyuan Hospital, China Academy of Chinese Medical Sciences, Beijing 100029, China

Corresponding author: XU Fengqin, Chief Physician; E-mail: Dr.xufengqin@outlook.com

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Abstract

Background: Elderly hypertension combined with cognitive impairment has become a major global public health concern. Systematically evaluating the prevalence of mild cognitive impairment (MCI) among elderly hypertensive patients in China can provide valuable data for the prevention and treatment of cognitive damage in this population.

Objective: To systematically evaluate the prevalence of MCI in elderly hypertensive patients in China using meta-analysis and to explore its development trend.

Methods: We systematically searched Chinese and English databases including CNKI, WanFang, VIP, CBM, PubMed, Cochrane Library, Embase, and

Web of Science from inception to February 2024. NoteExpress software was used for literature management and screening, and the Agency for Healthcare Research and Quality (AHRQ) cross-sectional study evaluation criteria were applied for quality assessment. Two researchers independently screened literature, extracted data, and evaluated study quality. Meta-analysis and subgroup analysis were performed using StataMP 14.0 software.

Results: Twenty-seven cross-sectional studies published between 2008 and 2023 were included, involving 57,461 elderly hypertensive patients with 11,812 MCI cases. Using a random-effects model, the overall prevalence was 21.3% (95%CI=18.4%-24.2%, P<0.001). The studies covered 11 provinces/autonomous regions/municipalities, with substantial variation in prevalence across regions. The prevalence showed a fluctuating upward trend from 2008 to 2023, consistently exceeding 10%. Subgroup analyses revealed that rural elderly hypertensive patients had a prevalence of 33.6% (95%CI=6.4%-60.7%, P<0.001), while urban patients had 21.8% (95%CI=18.1%-25.4%, P<0.001). North China showed lower prevalence (14.0%, 95%CI=9.3%-18.7%, P<0.001) compared to other regions. Combined MMSE+MoCA assessment yielded an MCI prevalence of 25.9% (95%CI=15.8%-36.0%), compared to 21.4% (95%CI=18.5%-24.4%) for MoCA alone and 17.9% (95%CI=13.9%-21.9%) for MMSE alone.

Conclusion: The overall prevalence of MCI in elderly hypertensive patients in China is high, with significant variations across provinces and between urban and rural areas, and shows a fluctuating upward trend over time. Different assessment tools yield varying detection rates. However, due to the limited number of studies and substantial heterogeneity, these findings require confirmation through further high-quality research.

Keywords: hypertension; aged; mild cognitive impairment; prevalence rate; development trend; meta-analysis

Introduction

According to the latest data from the National Bureau of Statistics, China' s population aged 60 and above exceeded 297 million by the end of 2023, with the aging trend continuing to deepen. The global burden of elderly hypertension, combined with increased healthcare costs due to cognitive impairment-related quality of life reductions, has made hypertension with comorbid cognitive impairment a significant public health challenge. The prevalence of hypertension increases linearly with age, exceeding 50% in those over 60 and approaching 90% in the oldest old. Existing research has demonstrated that hypertension significantly increases the risk of cognitive impairment.

Mild cognitive impairment (MCI) represents a pathological state between normal aging and dementia-related cognitive changes. In China, the number of MCI

patients has surpassed 38 million, with prevalence increasing with age. Current research on cognitive impairment in elderly hypertensive patients in China consists primarily of cross-sectional studies with distinct regional characteristics, and studies specifically focusing on MCI prevalence are relatively scarce. This meta-analysis systematically examines the prevalence and development trends of MCI in China' s elderly hypertensive population to provide data support for prevention and intervention strategies.

Methods

1.1 Inclusion and Exclusion Criteria Inclusion criteria: (1) Cross-sectional studies with clearly specified sampling methods; (2) Study subjects comprising elderly hypertensive patients in China aged $ $60 years; (3) Clear MCI diagnostic criteria and screening tools such as the Mini-Mental State Examination (MMSE), Montreal Cognitive Assessment (MoCA), etc.; (4) Original research.

Exclusion criteria: (1) Studies without clear age restrictions; (2) Studies including other types of cognitive impairment such as dementia; (3) Literature with incomplete data or duplicate publications.

1.2 Literature Search We systematically searched Chinese databases (CNKI, WanFang, VIP, CBM) and English databases (PubMed, Cochrane Library, Embase, Web of Science) from inception to February 22, 2024. Chinese search terms included "elderly," "hypertension," "cognitive impairment," and related variants. English search terms included "Aged," "Hypertension," "Cognitive Dysfunction," "Cognitive Impairment," and related terms. The PubMed search strategy is shown in .

1.3 Data Extraction Two researchers independently screened literature and extracted data. NoteExpress was used to manage duplicates. Initial screening was performed by title and abstract, followed by full-text review for eligible studies. Data extraction using Excel included: study title, authors, publication year, study period and region, study design and sampling method, sample size, and number of cases. After extraction, two reviewers cross-checked the data, with discrepancies resolved through discussion or by a third reviewer when necessary.

1.5 Statistical Analysis StataMP 14.0 software was used for meta-analysis. Effect sizes were expressed as prevalence rates with 95% confidence intervals (CI). Heterogeneity was assessed using I^2 statistics: fixed-effects models were used when $P>0.1$ and $I^2<50\%$, while random-effects models were applied when $P<0.1$ or $I^2$$ 50%. Subgroup analysis explored sources of heterogeneity. Meta-analysis used $\alpha=0.05$ for calibration. IBM SPSS Statistics 25.0 was used for ^{2} tests, with $P<0.05$ considered statistically significant.

Results

2.1 Literature Search Results The systematic search identified 8,641 relevant articles (5,297 Chinese and 3,344 English). After removing duplicates, 5,007 articles remained. Following title and abstract screening, 105 articles underwent full-text review. Ultimately, 27 articles were included in the meta-analysis [6,8-33]. The literature screening flowchart is shown in [Figure 1: see original paper].

2.2 Basic Study Information Twenty-seven cross-sectional studies were included, with a total sample of 57,461 elderly hypertensive patients and 11,812 MCI cases, covering 11 provinces/municipalities from 2008 to 2023 (a 15-year span). Basic characteristics including authors, year, region, age, sampling method, assessment tools, sample size, case numbers, and prevalence rates are summarized in .

2.4.1 Overall Prevalence of MCI in Elderly Hypertensive Patients The meta-analysis of 27 studies [6,8-33] showed significant heterogeneity (I^2=98.6%, P<0.001), requiring a random-effects model. The overall prevalence of MCI in elderly hypertensive patients in China was 21.3% (95%CI=18.4%-24.2%), as shown in [Figure 2: see original paper].

2.4.2 Trend Analysis of MCI Prevalence **2.4.2.1 Regional Distribution:** Studies covered 11 provinces/autonomous regions/municipalities with substantial regional variation. Shanghai, Tianjin, and Beijing had more studies and lower overall prevalence rates. Beijing showed the lowest prevalence at 13.61% (95%CI=2.30%-24.92%). Xinjiang, Jiangsu, Guangdong, and Hubei had fewer studies with greater variation and less reliable estimates. Regional prevalence rates are detailed in .

2.4.2.2 Temporal Distribution: With studies spanning 2008-2023 (approximately 15 years), prevalence showed a fluctuating upward trend, with the lowest rate in 2008 (11.87%) and highest in 2022 (36.78%). All annual rates exceeded 10%, though limited study numbers for individual years warrant cautious interpretation. Overall, prevalence demonstrates a dynamic upward trend over time, as shown in [Figure 3: see original paper].

2.4.3 Subgroup Analysis **2.4.3.1 Urban-Rural Distribution:** Rural elderly hypertensive patients showed a prevalence of 33.6% (95%CI=6.4%-60.7%), significantly higher than the 21.8% (95%CI=18.1%-25.4%) observed in urban patients . However, rural studies were limited (2 studies, n=5,381) compared to urban studies (18 studies, n=22,739).

2.4.3.2 Geographic Regions: Six major geographic regions were represented. North China had the largest sample (11,998 cases) with the lowest prevalence (14.0%, 95%CI=9.3%-18.7%, P<0.001) . Southwest China had only one study,

insufficient to represent the region, and no studies were available for Northeast China.

2.4.3.3 Assessment Tools: MMSE and MoCA were most commonly used. Combined MMSE+MoCA assessment yielded 25.9% prevalence (95%CI=15.8%-36.0%), compared to 21.4% (95%CI=18.5%-24.4%) for MoCA alone and 17.9% (95%CI=13.9%-21.9%) for MMSE alone .

2.4.3.4 Study Quality: Most studies were high quality (8-10 points). Both high-quality (21.5%, 95%CI=18.1%-24.9%) and medium-quality studies (21.3%, 95%CI=18.4%-24.2%) showed prevalence rates similar to the overall estimate, suggesting limited impact of study quality on the main findings .

Discussion

This meta-analysis systematically examined 27 cross-sectional studies from 2008-2023, including 57,461 elderly hypertensive patients with 11,812 MCI cases. Quality assessment using AHRQ criteria yielded scores of 6-10 points (20 high-quality, 7 medium-quality studies). The random-effects model showed an overall MCI prevalence of 21.3% (95%CI=18.4%-24.2%).

Comparative studies show some variation: QIN et al. [34] reported 26% MCI prevalence in Asian hypertensive patients and 28% in global populations over 60, while JIA et al. [6] found 18.5% in Chinese elderly hypertensive patients. These differences may relate to study timing, geographic location, and literature sources.

Our analysis examined spatial and temporal trends: (1) Spatially, significant variation existed across 11 provinces, with Shanghai, Tianjin, and Beijing showing lower rates, possibly reflecting stronger chronic disease prevention and early screening programs. (2) Temporally, prevalence showed dynamic fluctuations from 2008-2023, peaking in 2022, though limited annual data require cautious interpretation. Overall, a rising trend is evident.

Subgroup analyses revealed: (1) Rural prevalence (33.6%) exceeded urban (21.8%), consistent with previous meta-analyses showing higher MCI rates in rural elderly (23% vs. 16%) [35-36] and reflecting China' s aging population disparity and poorer rural health status [37]. (2) North China' s lower prevalence (14.0%) may relate to higher economic development and better elderly health services, though limited regional studies may introduce bias. (3) Combined MMSE+MoCA assessment detected higher prevalence than single-tool approaches, consistent with recommendations for combined screening in patients with cognitive complaints [38] and MoCA' s superior sensitivity/specificity for MCI [39-41]. (4) Study quality had minimal impact on overall prevalence estimates.

Limitations: (1) Cross-sectional design and substantial heterogeneity (I^2=98.6%) persisted despite subgroup analysis, potentially affecting result accuracy. (2) Geographic and temporal distributions were broad, but limited

studies per region/year reduce reliability of trend analyses. (3) Non-uniform MCI diagnostic and screening standards across studies may contribute to heterogeneity.

Conclusion

This meta-analysis demonstrates a high overall MCI prevalence (21.3%) in Chinese elderly hypertensive patients, with significant urban-rural and regional disparities and a dynamic upward trend over time. Rural residents and certain geographic regions show particularly elevated rates. Combined MMSE+MoCA screening may improve detection. Given the substantial heterogeneity and limited study numbers, these findings warrant confirmation through further high-quality research. Strengthening cognitive screening in elderly hypertensive patients and addressing regional disparities in public health resources are crucial for delaying cognitive decline and reducing dementia conversion.

Author Contributions

WANG Biqing: study design, literature search, data analysis, and initial manuscript drafting. ZHANG Ping: research conceptualization and quality review. YANG Hongxia: data extraction and analysis. WANG Qian and JU Chunxiao: manuscript revision. MEI Jun, ZHAO Junnan, and ZHANG Ying: feasibility analysis. XU Fengqin: manuscript review and overall responsibility.

Conflict of Interest

The authors declare no conflicts of interest.

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