Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/dyk92e37

EVALUATING BLOOD PRESSURE AND COGNITIVE IMPAIRMENT IN URBAN ELDERLY

Kuldeep Dineshbhai Varmora[1*], Brijesh Ketankumar Lakhani[2], Kalola Akshaybhai Ramjibhai[3], Chadamiya Uttam Dineshbha[4]

[1*,2]MBBS, Parul Institute of Medical Sciences & Research, Vadodara, Gujarat, India
[3]MBBS, GMERS Medical College and Hospital, Dharpur, Patan, Gujarat, India
[4]MBBS, UV Gullas College of Medicine, Cebu, Philippines

Corresponding author: Kuldeep Dineshbhai Varmora
*Parul Institute of Medical Sciences & Research, Vadodara, Gujarat, India Email: kuldeepvarmora1611@gmail.com

Abstract

Background: With rising life expectancy, cognitive dysfunction has emerged as a growing health concern among the elderly, especially in urban populations. Blood pressure, a critical modifiable risk factor, is increasingly being linked to cognitive decline. However, limited data exist on its correlation with cognitive function in the urban elderly population in India.

Aim: To assess the correlation between blood pressure and cognitive function as measured by the Mini Mental State Examination (MMSE) in the urban elderly population.

Materials and Methods: This cross-sectional study included 370 urban elderly individuals aged ≥60 years. Blood pressure was recorded using a digital sphygmomanometer, and cognitive status was assessed with the MMSE tool. Participants were categorized into two groups based on MMSE scores (>23 vs. ≤23). Statistical analysis was conducted using SPSS version 26, and the correlation between blood pressure and cognitive scores was evaluated using Pearson's correlation coefficient.

Results: The mean age of the study population was 71.26 ± 8.43 years. Participants with MMSE scores ≤23 showed significantly higher mean systolic blood pressure (143.72 ± 17.62 mmHg) compared to those with MMSE >23 (137.89 ± 15.94 mmHg, $p = 0.042$). Diastolic pressure was also significantly lower in cognitively impaired individuals (81.27 ± 10.14 mmHg vs. 85.64 ± 9.85 mmHg, $p = 0.036$). These findings indicate a significant inverse relationship between blood pressure abnormalities and cognitive function.

Conclusion: The study highlights a statistically significant association between abnormal blood pressure—particularly elevated systolic and lower diastolic pressure—and cognitive impairment in urban elderly individuals. These results underscore the importance of routine cognitive screening and optimal blood pressure control in elderly care.

Keywords: Cognitive dysfunction, Blood pressure, Urban elderly

Introduction

The global burden of cognitive impairment and dementia continues to rise, especially in aging populations. With increased life expectancy, urban communities are witnessing a significant demographic shift toward older age groups, making age-related disorders a public health priority. Among these, cognitive dysfunction — ranging from mild cognitive impairment to severe dementia

— has profound implications on an individual's independence, quality of life, and healthcare utilization [1].

Hypertension, or elevated blood pressure (BP), is one of the most prevalent modifiable risk factors affecting elderly populations. The pathophysiological link between high blood pressure and cognitive impairment has been increasingly recognized, with evidence suggesting that chronic hypertension contributes to cerebral small vessel disease, white matter lesions, and neurodegeneration [2,3]. The vascular theory of cognitive decline highlights the critical role of cerebrovascular dysregulation in the progression of dementia, particularly vascular dementia and even Alzheimer's disease [4].

The Mini-Mental State Examination (MMSE) is a widely used and validated screening tool to assess cognitive function in elderly individuals. It evaluates multiple domains including orientation, memory, attention, language, and visuospatial skills. Low MMSE scores are indicative of cognitive impairment and are frequently associated with structural brain changes [5].

Several studies have reported a strong association between elevated systolic blood pressure and reduced cognitive performance, especially in adults over 60 years of age [6,7]. Interestingly, both hypertension and hypotension have been implicated in cognitive decline, indicating a potential U-shaped relationship that underscores the importance of maintaining optimal blood pressure control [8]. Moreover, the impact of antihypertensive therapy on cognitive outcomes remains a subject of ongoing research, with some findings suggesting a protective effect when treatment is initiated in midlife [9].

In India, where urbanization is accelerating, the elderly urban population is increasingly exposed to lifestyle-related risk factors such as poor diet, physical inactivity, stress, and inconsistent healthcare access. Yet, there is limited data focusing on the correlation between blood pressure levels and cognitive dysfunction specifically in urban Indian elders. Early identification of cognitive decline in relation to blood pressure patterns could be pivotal in implementing preventive strategies and tailoring public health interventions [10].

This study, therefore, aims to assess the correlation between blood pressure levels and cognitive dysfunction, as measured by the MMSE, in an urban elderly population. By elucidating this relationship, the study seeks to support early intervention strategies and contribute to the broader understanding of aging, vascular health, and neurocognitive outcomes.

Material and Methods

This cross-sectional, observational study was conducted among elderly individuals aged 60 years and above residing in urban areas. A total of 370 participants were enrolled through simple random sampling from community health centers, senior citizen clubs, and residential colonies catering to the urban elderly population.

Inclusion criteria comprised individuals aged 60 years or above, living in urban settings, who consented to participate and were able to undergo blood pressure measurement and cognitive assessment. Individuals with known psychiatric illnesses, history of stroke, severe hearing or speech impairment, or those already diagnosed with dementia or undergoing treatment for cognitive impairment were excluded to minimize confounding variables.

After obtaining written informed consent, participants were interviewed and assessed in person. A pre-structured proforma was used to record socio-demographic details including age, gender, education, occupation, and comorbidities such as diabetes and hypertension.

Blood pressure was measured using a calibrated digital sphygmomanometer. Two readings were taken at a 5-minute interval in a seated position, and the average was considered for analysis. Participants were classified as normotensive, prehypertensive, or hypertensive based on current clinical guidelines.

Cognitive function was assessed using the Mini Mental State Examination (MMSE), a validated tool for detecting cognitive impairment. The MMSE includes items testing orientation, memory, attention, calculation, language, and visuospatial abilities. Scores range from 0 to 30, with lower scores indicating higher levels of cognitive dysfunction. A score of ≤ 23 was considered suggestive of cognitive impairment.

Data were recorded and compiled in Microsoft Excel and analyzed using SPSS software version 26. Descriptive statistics were used for baseline variables. The correlation between blood pressure categories and MMSE scores was analyzed using Pearson's correlation coefficient. A p-value of <0.05 was considered statistically significant.

Results

Table 1 presents the anthropometric characteristics of the study participants. The mean age of the elderly individuals was 71.26 years with a standard deviation of 8.43 years, indicating a moderately aged urban cohort. The average height of the participants was 157.48 cm (±8.89), while the mean body weight was 61.37 kg with a standard deviation of 10.96 kg. These values provide a general baseline for the physical status of the sample population involved in the cognitive and blood pressure correlation analysis.

Table 2 illustrates the correlation between blood pressure parameters—systolic and diastolic—with cognitive function as assessed by the MMSE scores. Among the 370 participants, those with MMSE scores >23 (n = 281) had a lower mean systolic blood pressure (137.89 ± 15.94 mmHg) compared to those with MMSE scores ≤23 (n = 89), who recorded a higher mean systolic pressure of 143.72 ± 17.62 mmHg. This difference was statistically significant (p = 0.042), suggesting a possible association between elevated systolic pressure and cognitive decline. Similarly, participants with MMSE scores ≤23 had a lower mean diastolic pressure (81.27 ± 10.14 mmHg) compared to those with higher MMSE scores (85.64 ± 9.85 mmHg), and this difference was also statistically significant (p = 0.036). These findings point toward a significant inverse correlation between blood pressure levels and cognitive function in the elderly urban population.

Table 1: Anthropometric measurements in study subjects (n = 370)

Parameter	Mean ± SD
Age in years	71.26 ± 8.43
Height (cm)	157.48 ± 8.89
Weight (Kg)	61.37 ± 10.96

Table 2: Correlation of systolic and diastolic blood pressure with MMSE in study participants (n = 370)

Parameter	MMSE Group	N	Mean ± SD	P-value
SBP	> 23	281	137.89 ± 15.94	0.042*
	≤ 23	89	143.72 ± 17.62	
DBP	> 23	281	85.64 ± 9.85	0.036*
	≤ 23	89	81.27 ± 10.14	

Discussion

The findings of the present study provide compelling insights into the association between blood pressure levels and cognitive function among the elderly population in urban settings. The statistically significant higher systolic and lower diastolic blood pressure values observed in participants with MMSE scores ≤23 support the hypothesis that blood pressure abnormalities—both elevated and reduced—may negatively influence cognitive abilities.

These findings are in alignment with recent studies that suggest a vascular component in the pathogenesis of cognitive decline. Persistent hypertension contributes to microvascular damage, impaired cerebral perfusion, and neurodegenerative changes, especially in frontal-subcortical circuits that govern executive functioning and memory [11]. Elevated systolic pressure, in particular, has been associated with hippocampal atrophy and increased risk of both vascular and Alzheimer's dementia [12].

Interestingly, the present study also demonstrated that participants with cognitive impairment had significantly lower diastolic blood pressure. This is consistent with literature suggesting that excessive antihypertensive treatment or age-related autonomic dysfunction could lead to cerebral

hypoperfusion, thereby exacerbating neurodegeneration [13]. These results highlight the delicate balance required in managing blood pressure in elderly patients—both hypertension and hypotension can impair cognitive integrity.

Additionally, studies have shown that the impact of blood pressure on cognition may vary with age. In middle-aged individuals, elevated BP appears more strongly correlated with future cognitive decline. However, in older adults, the relationship becomes complex, potentially influenced by arterial stiffness, medication effects, and comorbidities [14]. Therefore, MMSE-based cognitive screening should be considered a valuable component of routine geriatric assessment, especially in hypertensive patients, to promote early detection and intervention.

From a public health perspective, this study underlines the urgent need to integrate cognitive health into chronic disease management programs for the elderly. With India's rapid urbanization and the rising burden of non-communicable diseases, identifying modifiable vascular risk factors like blood pressure may offer an avenue to delay or prevent cognitive decline. Moreover, culturally adapted community-based interventions and cognitive health education should be promoted among the urban elderly to foster healthy aging [15].

Conclusion

This study demonstrates a significant correlation between abnormal blood pressure levels and reduced cognitive function in the urban elderly population, as measured by MMSE scores. Higher systolic and lower diastolic pressures were associated with cognitive impairment, suggesting that optimal regulation of blood pressure may be critical in maintaining neurocognitive health in later life. These findings advocate for a multidisciplinary approach involving geriatrics, neurology, and public health to effectively screen, manage, and prevent dementia-related decline through vascular health optimization.

Conflict of interest: No! Conflict of interest is found elsewhere considering this work.
Source of Funding: There was no financial support concerning this work

References

1. Livingston G, Huntley J, Sommerlad A, et al. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *Lancet*. 2020;396(10248):413–446.
2. Launer LJ, Hughes TM, White LR. Microvascular disease, dementia, and cognitive decline: New directions for research. *Neurology*. 2021;96(10):439–448.
3. Iadecola C, Gottesman RF. Neurovascular and cognitive dysfunction in hypertension. *Circ Res*. 2019;124(7):1025–1044.
4. Sweeney MD, Kisler K, Montagne A, Toga AW, Zlokovic BV. The role of brain vasculature in neurodegenerative disorders. *Nat Neurosci*. 2019;22(8):1573–1583.
5. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state." A practical method for grading the cognitive state of patients. *J Psychiatr Res*. 1975;12(3):189–198.
6. Qiu C, Winblad B, Fratiglioni L. The age-dependent relation of blood pressure to cognitive function and dementia. *Lancet Neurol*. 2021;20(4):333–343.
7. Mahinrad S, van Buchem MA, Zonneveld HI, et al. Blood pressure and risk of cognitive decline: A systematic review and meta-analysis of prospective studies. *J Am Heart Assoc*. 2021;10(13):e021590.
8. Tully PJ, Debette S, Nemeth B, et al. Blood pressure variability and cognitive decline: A systematic review and meta-analysis. *J Hypertens*. 2020;38(8):1460–1469.
9. Hughes D, Judge C, Murphy R, et al. Association of blood pressure lowering with incident dementia or cognitive impairment: A systematic review and meta-analysis. *JAMA*. 2020;323(19):1934–1944.
10. Patel V, Saxena S, Lund C, et al. The Lancet Commission on global mental health and sustainable development. *Lancet*. 2018;392(10157):1553–1598.

11. Ding J, Davis-Plourde KL, Sedaghat S, et al. Antihypertensive medication use and cognitive decline: The ARIC Study. *Hypertension*. 2020;76(4):955–963.
12. Lane CA, Hardy J, Schott JM. Alzheimer's disease. *Eur J Neurol*. 2018;25(1):59–70.
13. Molander L, Lovheim H, Wiberg B, et al. Lower systolic blood pressure is associated with greater risk of dementia in very elderly people. *J Intern Med*. 2019;285(3):251–258.
14. Jochemsen HM, Muller M, van der Graaf Y, et al. Blood pressure, hypertension, and cerebral blood flow: The SMART-MR study. *J Hypertens*. 2020;38(9):1751–1758.
15. Sosa-Ortiz AL, Acosta-Castillo I, Prince MJ. Epidemiology of dementias and Alzheimer's disease. *Arch Med Res*. 2021;52(4):367–374.