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COGNITIVE FUNCTIONAL IMPAIRMENT IN POST-ISCHEMIC STROKE PATIENTS WITH HYPERTENSION

By
Hasan Nidlom[1], Eko Budi Santoso[2]
[1,2]Program Studi Keperawatan dan Pendidikan Profesi Ners Institut Kesehatan dan Bisnis Surabaya
Email: [1]hasan.diwan12@gmail.com

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ABSTRACT

Stroke can cause functional brain disorders in the form of cognitive impairment. The incidence of cognitive impairment increases threefold after stroke, and usually involves impairment of visuospatial abilities, memory, orientation, language, attention, and executive function. This study used a cross-sectional method. The data obtained were analyzed descriptively (univariate), followed by a chi-square test for bivariate analysis, and logistic regression was used for multivariate analysis. The sample obtained was 110 samples, consisting of 72 men (65%) and 38 women (34.5%), with the most age group 51-60 years as many as 36 patients (32.7%). 75 patients (68.2%) experienced cognitive impairment (MoCA < 26) and 35 patients (31.8%) did not experience cognitive impairment (MoCA ≥ 26). Bivariate analysis found that hypertension (OR: 1.02; CI: 0.70-1.49; p: 0.823) did not affect the occurrence of cognitive impairment in post-stroke patients. Multivariate analysis found that the onset of recurrent stroke, the number of lesions, parietal lesions, and temporal lesions were associated with cognitive impairment after ischemic stroke. Hypertension was not associated with cognitive impairment in post-stroke patients

Corresponding Author:
Hasan Nidlom
Program Studi Keperawatan dan Pendidikan Profesi Ners Institut Kesehatan dan Bisnis Surabaya
Email: hasan.diwan12@gmail.com

1. INTRODUCTION

Cognitive impairment is a common complication in patients after ischemic stroke. Stroke, especially ischemic stroke, can cause damage to areas of the brain that play a crucial role in various cognitive functions such as visuospatial abilities, memory, orientation, language, attention, and executive function. The incidence of cognitive impairment in post-stroke patients is reported to be up to threefold higher than in the general population. Hypertension is a major risk factor for ischemic stroke and plays a significant role in the pathological processes affecting the brain. Hypertension can trigger ischemia in the brain, particularly in the parahippocampal gyrus, which contributes to cognitive impairment in post-ischemic stroke patients. Observational studies have shown a significant association between hypertension and cognitive impairment in ischemic stroke patients, with hypertension being the trigger for brain ischemia that ultimately leads to cognitive decline. (Shaw L, Rodgers H, Price C, van Wijck F, Shackley P, Steen N, et al.. 2019)

However, several studies have also reported that the direct relationship between hypertension and cognitive impairment in post-ischemic stroke patients is not always statistically significant. Other factors

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such as stroke onset, history of recurrent strokes, and the number and location of lesions in the cerebral cortex, particularly in the parietal and temporal regions, are known to play a more significant role in cognitive impairment. Therefore, it is important to understand the complex relationship between hypertension and cognitive impairment in post-ischemic stroke patients so that appropriate interventions can be provided to optimize cognitive recovery and prevent further complications. (Sabia, S., Elbaz. 2019). This introduction will discuss the phenomenon of cognitive dysfunction in post-ischemic stroke patients with hypertension, including epidemiological and pathophysiological aspects, as well as related research results to provide a basis for clinical management and further research. (Veerback JM, Koolstra M, Ket JC, van Wegen EE, Kwakkel G. 2021)

Thus, it is important to understand the complex relationship between hypertension and cognitive impairment in post-ischemic stroke patients so that appropriate interventions can be provided to optimize cognitive recovery and prevent further complications. This introduction will discuss the phenomenon of cognitive impairment in post-ischemic stroke patients with hypertension, covering epidemiological and pathophysiological aspects, as well as related research findings to provide a foundation for clinical management and further research. (Saedi, E. 2016).

The World Health Organization (WHO) defines stroke as a clinical sign that develops rapidly, due to focal or global disturbance accompanied by symptoms that last for 24 hours or more, can cause death without any clear cause other than vascular. (Fitzsimmons 2022). Approximately 80%-85% of strokes are ischemic strokes. Ischemic strokes occur due to obstruction or blood clots in one or more large blood vessels in the cerebral circulation. (Price 2021).

Cognitive impairment is a common complication in patients after ischemic stroke. Ischemic stroke causes brain tissue damage due to impaired blood supply, resulting in impairments in various cognitive domains, such as memory, attention, executive function, and visuospatial abilities. The incidence of cognitive impairment in post-stroke patients is up to threefold higher than in the general population. Hypertension is a major risk factor for ischemic stroke and can exacerbate brain damage through vascular mechanisms and neural degeneration, potentially contributing to post-stroke cognitive impairment. However, the direct relationship between hypertension and cognitive impairment in post-ischemic stroke patients remains controversial and requires further study. This study aims to determine the relationship between hypertension and cognitive impairment in post-ischemic stroke patients, as well as other factors that influence this cognitive impairment.

2. METHODS

This study used a cross-sectional approach method, conducted at the Stroke Center of Hospital X. The population of this study were all ischemic stroke patients registered in the stroke register in the Stroke Epidemiology Profile. Sampling used a consecutive sampling technique. The sample criteria included in the study were ischemic stroke patients diagnosed using a head CT scan, aged > 18 years, ischemic stroke patients, first or recurrent stroke, and signed a consent form as research subjects or represented. Criteria that were not included in the sample were patients with incomplete data recording and not included in the stroke register, patients with a history of Alzheimer's disease, Parkinson's, dementia before stroke, epilepsy, head trauma, brain tumors, and meningoencephalitis, patients with delirium, patients with upper limb paralysis/hemiparases of the dominant body part, patients who experienced a decrease in consciousness, patients with visual and hearing disorders, and patients with severe depression. The number of samples in this study was 110 ischemic stroke patients. The sample was taken with the criteria of patient readiness and consent.

Cognitive function data were obtained using standardized instruments such as the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina) and the Clock Drawing Test (CDT) at specific times after stroke (e.g., 30 days or 3 months post-stroke). Primary hypertension data were also collected from patient medical records. Data analysis included descriptive analysis to describe patient characteristics and chi-square tests and logistic regression to examine the relationship between hypertension and cognitive impairment and other predisposing factors such as age, stroke onset, and the number and location of brain lesions.

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3. RESULT AND DISCUSSION

Result

The study sample consisted of 110 post-ischemic stroke patients with hypertension, consisting of 65% men and 35% women, with the majority aged 51-60 years. Samples that met the inclusion criteria were included in a descriptive analysis that described the characteristics of all patients, as shown in Table 1.

Patient Characteristics	Persent	Total
Gender		
Male	36,5	40
Female	62,5	70
Age		
40-50	10.9	12
51-60	32.7	36
61-70	30.9	34
>70	25.5	28
Hipertension		
Yes	70.0	77
No	30.0	33
Skoring MoCA-Ina		
< 26	68.2	75
≥ 26	31.8	35

The baseline characteristics of the study subjects were assessed by gender, age, educational background, history of hypertension, smoking history, history of atrial fibrillation, history of diabetes mellitus, history of dyslipidemia, history of stroke, number of cortical lesions, lesion location (frontal, occipital, parietal, temporal), MoCA-Ina score, and CDT score. The independent variable (hypertension) was examined for its association with the dependent variable (cognitive impairment in post-ischemic stroke patients) using bivariate analysis. The results of the analysis are shown in Table 2 above. Based on the analysis, hypertension was not statistically associated with cognitive impairment in post-ischemic stroke patients.

After the bivariate analysis using chi-square, the associated variables were retested using logistic regression to determine which variables were truly associated with cognitive impairment in post-ischemic stroke.

Variable	Cognitive Function Disorder	No Cognitive Impairment	OR	95% CI	p Value
	(n=75)	(n=35)			
Gender					
Male	51 (70.8%)	21 (29.2%)	1.417	0.616-3.256	0.411
Female	24 (63.2%)	14 (36.8%)			
Age					
40-50	8 (66.7%)	4 (33.3%)			
51-60	19 (52.8%)	17 (47.2%)	0.56	0.11-2.60	0.007
61-70	22 (64.7%)	12 (35.3%)	0.92	0.18-4.43	
>70	26 (92.9%)	2 (7.1%)	6.5	0.78-64.95	
Hypertension					
Yes	53 (68.8%)	24 (31.2%)	1.02	0.70-1.49	0.823
No	22 (66.7%)	11 (31.8)			

Bivariate test results showed that hypertension had no statistically significant association with cognitive impairment in post-ischemic stroke patients (p=0.823; OR=1.02). However, other factors such as stroke onset, number of cortical lesions, and lesion location in the parietal and temporal areas showed a

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significant association with cognitive impairment ($p<0.05$). Thus, hypertension as an independent variable was not proven to significantly contribute to cognitive impairment after stroke, although it remains a risk factor for stroke itself..

Discussion

Cognitive impairment in post-ischemic stroke patients is a complex and multifactorial condition. Although hypertension is a primary risk factor for ischemic stroke, this study did not find a statistically significant direct association between hypertension and post-stroke cognitive impairment. This is consistent with several other studies showing that factors such as stroke lesion location, number of lesions, patient age, and stroke onset play a more dominant role in determining post-stroke cognitive impairment.

Descriptive analysis revealed that of the 110 patients, 75 (68.2%) experienced cognitive impairment (MoCA-Ina <26) and 35 (31.8%) did not experience cognitive impairment (MoCA-Ina <26). According to the descriptive analysis, 72 (65.5%) were male and 38 (34.5%) were female. Analytical tests were conducted using the chi square test method, to see whether there was a relationship between the dependent variable (disorder) and the independent variable (hypertension). The results using the Clock Drawing Test (CDT) showed that 63 patients (57.3%) did not experience spatial cognitive impairment. It can be concluded that the comparison between CDT and MoCA-Ina showed that more patients were detected to have cognitive impairment when examined using MoCA-Ina. The results obtained are in accordance with research from Husein et al (2009) that the validity and reliability of MoCA in detecting mild cognitive impairment are 90-96% sensitive and 87-95% specific.

Damage to the parietal and temporal lobes appears to be most impactful because these areas play a crucial role in cognitive functions such as memory and visuospatial processing. Hypertension may contribute to the development of chronic vascular damage and changes in cerebral small vessel disease, but its direct effect on cognitive impairment may be more difficult to measure. These findings emphasize the importance of a multidisciplinary approach in the care of post-stroke patients to identify and manage various risk factors for cognitive impairment, beyond focusing solely on hypertension. Early intervention and cognitive rehabilitation may be necessary to maximize cognitive function and quality of life in post-stroke patients.

Cognitive impairment in post-ischemic stroke patients with hypertension is a common clinical problem and has a long-term impact on patient quality of life (Eko Budi Santoso and Hasan Nidlom, 2025). Ischemic stroke causes brain tissue damage due to blockage of blood vessels, which reduces the supply of oxygen and nutrients to neural tissue. This condition triggers damage in brain areas responsible for various cognitive domains, such as memory, attention, executive function, visuospatial abilities, and language. (Santoso, E. B. ., Sukmana , D. G. . and Akbar, H. . 2023).

Hypertension is known as one of the main risk factors for ischemic stroke. Pathophysiologically, hypertension causes structural changes in cerebral blood vessels, such as thickening of arteriole walls, increased perivascular spacing, and damage to the blood-brain barrier (Hasan Nidlom And Eko Budi Santoso (2025). This process will lead to chronic ischemia and white matter changes that lead to decreased cognitive function, through a mechanism known as cerebral small vessel disease. Excess blood pressure can also cause microinfarcts and microvascular injury that contribute to myelin degeneration and oligodendrocyte apoptosis in brain tissue.

Several theories support the idea that hypertension accelerates the onset of vascular dementia, particularly by involving subcortical areas frequently affected in ischemic stroke. However, recent studies have shown varying results regarding the direct relationship between hypertension and the severity of post-stroke cognitive impairment. Statistics often indicate that the location and number of brain lesions, advanced age, and a history of recurrent stroke are more dominant predictors of cognitive impairment than hypertension itself.

4. CONCLUSION

Hypertension is not associated with cognitive impairment in post-ischemic stroke patients. Cognitive impairment in post-ischemic stroke patients with hypertension is a multifactorial problem. Although hypertension is a major risk factor for stroke, theoretically and clinically, the location and number of brain

lesions, history of stroke, and other comorbid conditions play a significant role in exacerbating cognitive impairment. Therefore, a multifactorial and comprehensive approach is needed in the management of these patients.

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