

VASCULAR RISK FACTOR AND COGNITIVE IMPAIRMENT IN ELDERLY

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ABSTRACT

The number of old individuals worldwide is rising. In developing countries, the elderly population is increasing more quickly than in developed countries. The elderly are more likely to experience cognitive impairment, especially those who have a vascular risk factor. The purpose of this study was to determine the relationship between vascular risk factors and cognitive impairment in the elderly. The observational research method with cross-sectional design consists of 79 participants in Tresna Werdha Puspa Karma Social Institution, Mataram, from October to November 2021. The subjects were measured blood pressure, weight, and height to obtain BMI, glucose level, and total cholesterol. Furthermore, each participant underwent a cognitive function test using Moca-INA. Data were analyzed by chi-square and logistic regression. Our study's participants ranged in age from 60 to 112 years old. In all, 12.7% were obese, 54.4% of participants had hypertension, 19% participants had diabetes mellitus and hyperglycemia, and 26.6% participants had hypercholesterolemia. Most participants (77.2%) had cognitive impairment with Moca-INA less than 24. On bivariate analysis, the result was diabetes mellitus ($p = 0.09$), hypertension ($p = 0.037$), lower education ($p = 0.01$), and high blood pressure ($p = 0.036$) were associated with poorer cognitive function. After multivariate analysis, consistent results affecting cognitive impairment, namely hypertension, high blood pressure, diabetes mellitus, and low education.

Keywords: Cognitive Impairment; Diabetes Mellitus; Hypertension; Vascular Risk Factor

INTRODUCTION

The global population of elderly people is growing. Compared to developed nations, the elderly population in developing nations is growing at a faster rate. Between 2017 and 2050, it is anticipated that there will be 1.7 billion older people in developing nations, up from 652 million in 2017. There will be approximately 79% of 60 years old and overpopulation in developing nations.¹ This increase in the elderly population will raise the prevalence of disease and disability, particularly cognitive function disorders.² There are approximately 50 million people worldwide who suffer from dementia, and approximately 60% of these people live in developing nations. There are 10 million new cases each year. By 2050, there will be 152

million people with dementia, up from 82 million in 2030. Countries with middle and low incomes see the majority of this rise in dementia cases.³ There is no national research data on the prevalence of dementia in Indonesia. However, Indonesia, with an increasing elderly population, will find many cases of dementia. Vascular dementia is estimated to be quite high in this country. Data from the Indonesia Stroke Registry 2013 reported that 60.59% of stroke patients experienced cognitive impairment when the nurse returned home from the hospital.⁴

Mild cognitive impairment in the elderly shows a condition of decreased memory, attention, and cognitive function that exceeds estimates based on age and education.⁵ Memory loss, learning difficulties, and a decrease in the ability to concentrate are hallmarks of cognitive impairment in the

elderly. This disorder is graded, ranging from mild deficits that are clinically undetectable to dementia.^{6,7} There are several causes of cognitive impairment, including vascular conditions, neuronal degeneration, and stroke. The elderly with cognitive impairment have a lower quality of life and a higher risk of dementia and death.^{7,8}

Mild cognitive impairment was found in 6.7 percent of people between the ages of 60 and 64, 8.4 percent of people between the ages of 65 and 69, 10.1 percent of people between the ages of 70 and 74, 14.8 percent of people between the ages of 75 and 79, and 25.2 percent of people between the ages of 80 and 84 years.⁹ Recent studies have shown that mild cognitive impairment affects 10-25 percent of people over the age of 65.¹⁰ There is strong evidence that individuals with mild cognitive impairment have a greater risk of developing dementia than individuals with normal cognitive impairment. In a systematic review study, it was found that around 32 percent of people with cognitive impairment developed dementia after five years. Increasing age is the strongest risk factor for general cognitive decline.¹¹ The goal of this study is to find a connection between vascular risk and cognitive impairment in the elderly.

MATERIAL AND METHODS

We conducted an analytical observational study with a cross-sectional method. This study's sample consisted of 79 people who were 60 or older. The following were the criteria for inclusion: (1) 60 years and older; (2) no stroke history; 3) consented to the study's participants. The following were the criteria for exclusion: (1) acute medical conditions; (2) neither the participants nor their guardians consented to the study. This research was conducted at the Tresna Werdha Puspa Karma Social Institution in October-November 2021.

After receiving the explanation and signing the informed consent, the subjects were measured blood pressure, weight, and height to obtain BMI, glucose level, and total cholesterol. Furthermore, each participant underwent a cognitive function test using

Moca-INA. Cut off point Moca-INA is 24, so the results of Moca-INA less than 24 considered to have cognitive impairment.¹² This research was approved by The Ethics dan Research Commission Medical Faculty of Islamic Al-Azhar University no 35/EC-03/FK-06/UNIZAR/IX2021. The collected data were analyzed using SPSS IBM version 26. The subjects' characteristics were analyzed descriptively using percentages and mean. Statistical analyses for two-group comparisons were performed with the chi-square and fisher tests. Multivariate analysis was performed with logistic regression.

RESULT

This study included 79 participants in total. Our study's participants ranged in age from 60 to 112 years; 70 (88.6%) participants of 60 to 79 years, and 9 (11.4%) participants of ≥ 80 years. In all, 54.4% (43 of 79) of participants had hypertension, 19% (15 of 79) participants had diabetes mellitus and hyperglycemia, and 26.6% (21 of 79) participants had hypercholesterolemia. Most participants (77.2%) had cognitive impairment with Moca-INA less than 24 (see Table 1).

In bivariate analysis, diabetes mellitus, hypertension, lower education, and high blood pressure were associated with poor cognitive functioning (Table 2). In logistic regression analysis, hypertension, diabetes mellitus, and high blood pressure were associated with decreased cognitive function, and higher education was associated with better cognitive function.

DISCUSSION

In this study, we explored vascular risk factors and cognitive impairment in the elderly. Lower education, diabetes mellitus, hypertension, and high blood pressure are associated with decreased cognitive function. The result is similar to the previous study that showed that mild cognitive impairment is more likely to present in patients with cerebral vascular disease than those without it.¹³

Hypertension is a known risk factor for mild cognitive impairment (MCI), and studies

have shown that adults with MCI who have elevated blood pressure have a higher risk of developing dementia.^{14,15} In this study, hypertension and high blood pressure are associated with cognitive impairment, this finding is consistent with previous studies.¹⁶⁻¹⁸ Hypertension is correlated with cognitive impairment, mainly in visuospatial and executive function in the elderly.¹⁸ A head CT scan of a hypertensive patient revealed cortical atrophy or leukoaraiosis in the hippocampus. Uncontrolled hypertension

causes cerebral vascular dysfunction due to modification of the vascular endothelium and extensive white matter damage that can lead to decreased cognitive function.¹⁹ Hypertension can also cause inflammation through the mechanism of damage to the blood-brain barrier and microglia activation. In addition, hypertension is associated with brain atrophy and increased neuritic plaques in the neocortex and hippocampus.²⁰

Table 1. Basic Characteristics of Subject in our study

Characteristic	Mean±SD	Total	%
Age group	70.39±8.98		
60-79 years		70	88.6
≥80 years		9	11.4
Gender			
Male		12	15.2
Female		67	84.8
Formal education			
Not educated		17	21.5
Elementary school		3	3.8
Junior high school		4	5.1
Senior high school		22	27.8
University		33	41.8
Hypertension			
Yes		43	54.4
No		36	45.6
Smoking			
Yes		10	12.7
No		69	87.3
Diabetes mellitus			
Yes		15	19
No		64	81
Blood pressure			
≥140/90mmHg		51	64.6
<140/90mmHg		28	35.4
BMI			
Underweight (<18.5)		15	19
Normal (18.5-24.9)		37	46.8
Overweight (25-29.9)		17	21.5
Obese (≥30)		10	12.7
Cholesterol			
<240mg/dL		58	73.4
≥240mg/dL		21	26.6
Blood glucose			
≥ 200mg/dL		15	19
< 200mg/dL		64	81
Moca Ina			
<24		61	77.2
24-30		18	22.8

Table 2. Bivariate analysis of vascular risk factors and others in relation to cognitive impairment

Variable	Cognitive impairment				PR (IK 95%)	P
	yes		no			
	n	%	n	%		
Age group						
60-79 years	9	11.4	0	00.0	0.743	0.084
≥80 years	52	65.5	18	22.8	(0.647-0.853)	
Gender						
Male	9	11.4	3	3.8	0.865	0.550
Female	52	65.8	15	2.,8	(0.208-3.607)	
Formal education						
≤6 year	20	25.3	0	0.0	1.439	0.002
>6 year	41	51.9	18	22.8	(1.215-1.704)	
Hypertension						
Yes	37	46.8	6	7.6	3.083	0.042
No	24	30.4	12	15.2	(1.020-9.323)	
Smoking						
Yes	9	11.4	1	1.3	2.942	0.440
No	52	65.8	17	21.5	(0.347-24.941)	
Diabetes mellitus						
Yes	15	19	0	0.0	1.391	0.013
No	46	58.2	18	22.8	(1.194-1.622)	
Blood pressure						
≥140/90 mmHg	44	55.7	7	8.9	4.067	0.011
<140/90 mmHg	17	21.5	11	13.9	(1.353-12.226)	
BMI						
≤24,9 kg/m ²	39	49.4	13	16.5	0.682	0.362
≥25 kg/m ²	22	27.8	5	6.3	(0.215-2.167)	
Cholesterol						
≥240mg/dL	16	20.3	5	6.3	0.924	0.558
<240mg/dL	45	57	13	16.5	(0.284-3.004)	
Blood glucose						
≥ 200mg/dL	13	16.5	2	2.5	2.167	0.275
< 200mg/dL	48	60.8	16	20.3	(0.441-10.652)	

Table 3. Multivariate analysis of factors influencing cognitive impairment

Variable	p
Formal education	0.01
Diabetes Mellitus	0.03
Hypertension	0.037
Blood pressure	0.036
Age	1.00

Studies have shown that there is an association between diabetes and an increased risk of cognitive impairment, MCI, and dementia, and the progression of MCI to dementia is higher in patients with diabetes.²¹ In this study, diabetes mellitus is associated with cognitive impairment, and this finding is consistent with the previous studies.^{22–24} The pathophysiology of cognitive impairment in diabetes mellitus is complex but is likely to involve impaired insulin signaling, increased inflammatory and oxidative stress pathways, and defects in mitochondria metabolism and regulation.²⁵

The effect of dyslipidemia on cognitive impairment remains unclear. A review of the literature on the relationship between plasma lipids, statins, and cognition concluded that the mechanism of this relationship is still not understood.²⁶ In this study, dyslipidemia was not associated with cognitive impairment, consistent with previous studies.^{27,28}

The effect of body mass index (BMI) on cognitive impairment remains controversial. Studies have shown that a higher BMI was associated with cognitive decline^{29,30}, and others have shown that a higher BMI was associated with better cognitive performance.³¹ Another research found a reciprocal relationship between BMI and cognitive abilities. There are negative effects of a higher BMI on midlife through late life, and that weight loss in late life is associated with cognitive decline.³² In this study, body mass index was not associated with cognitive impairment.

CONCLUSION

Our findings showed that hypertension, high blood pressure, and diabetes mellitus are associated with cognitive impairment in the elderly. Further research on the cognitive effects of vascular risk factors on a larger sample size and the longitudinal study can lead to interventions to effectively control these modifiable risk factors and prevent cognitive impairment in the elderly.

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