The Relationship between Hypertension and Cognitive Function Impairment in the Elderly

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The Relationship between Hypertension and Cognitive Function Impairment in the Elderly

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Abstract

BACKGROUND: Hypertension is still a health problem both in developed and developing countries. Hypertension can cause various complications; one of them is cognitive function impairment.

AIM: This study aimed to look at the relationship of hypertension with cognitive function. This research can also be useful to help optimise the health of the elderly, maximise quality of life and avoid hypertension as a risk factor for cognitive impairment in the elderly at the Karya Kasih Nursing Homes, Medan from May to June 2018.

METHODS: This research was carried out by analytic observational with cross-sectional research approach. In this study, 57 elderly from Karya Kasih Nursing Homes Medan who met the inclusion and exclusion criteria participated. Assessment of cognitive function used Mini-Mental State Examination (MMSE), Six Item Cognitive Impairment Test (6CIT) and Abbreviated Mental Test Score (AMT) instruments.

RESULT: This study obtained a significant relationship between the history of hypertension with impaired cognitive function (p = 0.003). The results of the cognitive function examination with MMSE showed that among 57 elderly, 16 people (43.2%) were normal and 21 people (56.8%) had impaired cognitive function in the first degree hypertension group, besides that, 3 people were normal (15%) and 7 people (85%) had impaired cognitive function in the second degree hypertension group (p = 0.031). Based on the result of mild and severe cognitive function impairment, among 12 people (57.1%) and 9 people (42.9%) had a mild and severe cognitive function impairment, respectively, in first-degree hypertension. 3 people (17.6%) and 14 people (82.4%) had a mild and severe cognitive function impairment, respectively, in the second-degree hypertension (p = 0.013). The 6-CIT instrument also showed a significant relationship between the severity of hypertension and impaired cognitive function (p = 0.027), and there was no significant relationship with AMT instruments (p = 0.078).

CONCLUSION: There was a relationship between the history or duration and degree of hypertension with cognitive dysfunction in the elderly at the Karya Kasih Nursing Home Medan.

Introduction

Hypertension is still one of the major challenges of diseases in the world, both developed and developing countries. Hypertension is the causes of death around 9.4 million people every year throughout the world, and it is expected to continue increasing along with changes in human lifestyle and technology [1]. It's estimated that 20% or one in five people in developed countries, such as America, has hypertension. This situation showed that hypertension in developed countries is the most dominant health problem and requires serious treatment. The high mortality rate due to hypertension causes the developed countries to be alert of this disease attack [2], [3].

In America, from 67 million adults, 31% or one in three people experience hypertension. According to the Center for Disease Control and Prevention (CDC),

hypertension is a major risk factor for kidney disease [3]. In Indonesia, there are 25.8% of the adult population suffering from hypertension. Hypertension ranked first of the ten most common diseases in the elderly in 2013 with the proportion of 45.9% in the 55-64-year age group, 57.6% in the 65-74-year age group and 63.8% in the age group over 75 years [4].

Long-Time hypertension can cause various problems in the human body. High blood pressure is a pathological condition that can cause abnormalities in various organs such as the heart, blood vessels, kidneys, eyes and brain. The brain is an organ that functions in terms of intelligence. Problems in the brain will be related to intelligence known as cognitive function [5].

Cognitive is a mind work process that makes human aware of the mind object or perception, including all aspects of observation, thought and memory [6]. Cognitive consists of various functions, including orientation, language, attention, calculation, memory, construction and reasoning [7]. The World Health Organization (WHO) in 2008 reported that the incidence of cognitive impairment in the elderly was estimated at 121 million people, with 5.8% of them as men, and 9.5% of them was women [8].

There are several instruments to assess a person's cognitive functioning abilities, including the Mini-Mental State Examination (MMSE), the Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina), Clock Drawing Test (CDT), California Verbal Learning Test (CVLT), Mini-cog, Abbreviated Mental Test Score (AMT), Six Item Cognitive Impairment Test (6CIT). Assessment of cognitive function in this study use the MMSE instrument; MMSE was the complete assessment instrument with 7 cognitive aspects. Sensitivity and specificity of the MMSE instrument were 83% and 87%, respectively. Based on that reason, this study uses MMSE as an instrument to determine cognitive function in the elderly. AMT and 6-CIT is used as comparison assessment [9].

Data from the Indonesian Ministry of Health in 2012 stated that the prevalence of hypertensive patients with cognitive impairment was 7-9% [10]. According to Abadi et al., there was a statistically significant relationship between hypertension and cognitive function in the elderly (P = 0.01). According to several studies, chronic hypertension can cause the narrowing and sclerosis process of small arteries in the subcortical region, resulting in hypoperfusion, loss of autoregulation, decrease in the brain barrier, and ultimately lead to brain cell death and impaired cognitive function [11].

This study aimed to look at the relationship of hypertension with cognitive function. This research can also be useful to help optimise the health of the elderly, maximise quality of life and avoid hypertension as a risk factor for cognitive impairment in the elderly.

Material and Methods

This research was carried out by analytic observational with cross-sectional research approach. This study was to determine the relationship of hypertension with cognitive function disorders in the Karya Kasih Nursing Homes Medan from May to June 2018. Observations of the variables were only for a moment and only one observation during the study.

Inclusion Criteria were: a) Elderly with hypertension; b) Willing to participate in the research; c) Elderly aged ≥ 60 years; d) Elderly education at least was elementary school graduate and able to speak Indonesian.

Exclusion criteria were: a) Elderly with hearing loss; b) Elderly with a history of stroke; c) Elderly with a history of severe head trauma.

The variables examined in this study are: 1. the independent variable is blood pressure and; 2. the dependent variable is MMSE, 6CIT and AMT.

In this study, the patient's blood pressure data were obtained from the report of the examination results using mercury sphygmomanometer. Assessment of cognitive function was done using MMSE, 6CIT and AMT instruments.

Table 1: Basic characteristic of the research subject

Characteristic	Value (n)	Presentation (%)
Age		
Elderly (60-74)	22	38.6
Old (75-90)	34	59.6
Very old (> 90)	1	1.8
Gender		
Man	18	31.6
Woman	39	68.4
Level of education		
Elementary and junior high school	32	56.1
Senior high school	15	26.3
Diploma and Bachelor	10	17.5
	-	-
Blood pressure (JNC VII)		
Normal	9	10.7
Pre-hypertension	18	21.4
Hypertension grade 1	37	44.1
Hypertension grade 2	20	23.8
Cognitive function (MMSE)		
Normal	19	3.3
Mild impairment	15	26.3
Severe impairment	23	40.4
Cognitive function (AMT)		
Normal	29	50.9
Dementia	28	49.1
Cognitive function (6-CIT)		
Normal	19	33.3
Mild cognitive impairment	6	10.5
Severe cognitive impairment	31	54.4
History of hypertension		
< 5 years	26	45.6
> 5 years	31	54.4

Data were analysed using statistical calculations to test the hypothesis with the Pearson correlation test method. If the data was not normally distributed based on normality test, then the hypothesis test can be done by the Spearman correlation test method.

Results

In this study, 57 respondents from Karya Kasih Nursing Home Medan who met the inclusion and exclusion criteria were taken into research.

Based on the results obtained it can be seen that of the 22 elderly in the elderly age category (60-74 years), there were 12 people (54.5%) had a normal cognitive function, and 10 people (45.5%) had cognitive impairment.

Of the 34 elderly in the old age group (75-90 years), there were 7 people (20.6%) had a normal cognitive function, and 27 people (79.4%) experienced cognitive impairment. Whereas for the elderly with very old age (> 90 years) there was only 1 person, and the elderly experienced impaired cognitive function (100%) (Table 2).

Table 2: Cognitive Function Distribution (MMSE) in the elderly based on age

Variable		Cognitive function				Total	
		Normal		Disturbed			
		n	%	n	%	n	%
Age	Elderly (60-74)	12	54.5	10	45.5	22	100
	Old (75-90)	7	20.6	27	79.4	34	100
	Very old (> 90)	0	0	1	100	1	100
Total		19		38		57	100

Based on Table 3, it can be seen that out of 39 senior women, there were 11 people (28.2%) who had a normal cognitive function and 28 people (71.8%) elderly experienced impaired cognitive function. While about 18 senior men, there were 8 people (44.4%) had a normal cognitive function and 10 people (56.6%) experienced impaired cognitive function.

Table 3: Cognitive function distribution (MMSE) based on gender

Variable		Cognitive Function				Total	
		Normal		Disturbed			
		n	%	n	%	n	%
Age	Woman	11	28.2	28	71.8	39	100
	Man	8	44.4	10	56.6	18	100
Total		19		38		57	100

Based on table 4, it can be seen that out of 26 older adults who had a history of hypertension less than 5 years, there were 14 people (53.8%) who had a normal cognitive function, and 12 people (46.2%) had impaired cognitive function. Whereas about 31 older adults who had a history of hypertension more than 5 years, there were 5 people (16.1%) had a normal cognitive function, and 26 people (83.9%) experienced impaired cognitive function.

The results of the chi-square test showed a relationship between the history of hypertension and cognitive dysfunction (MMSE) with p < 0.005. This means that the longer someone has a history of hypertension (over 5 years), the greater the occurrence of cognitive impairment.

Table 4: Relationship between a history of hypertension and cognitive function impairment (MMSE) in the elderly

Variable		Cognitive Function		P – value
		Normal n %	Disturbed n %	
History of hypertention	< 5 years	14 53.8	12 46.2	0.003
	> 5 years	5 16.1	26 83.9	
Total		19 33.3	38 66.7	

Based on the analysis of chi-square statistical tests obtained P-value = 0.031 (P < 0.05) means that there was a significant relationship between hypertension and cognitive function in the elderly.

Table 5: Relationship between the degree of hypertension and cognitive function impairment (MMSE) in the elderly

Variable		Cognitive function impairment		Total	P – value
		Normal n %	Disturbed n %	n %	
Hypertension	Grade 1	16 43.2	21 56.8	37 100	0.031
	Grade 2	3 15.0	17 85.0	20 100	
Total		19 33.3	38 66.7	57 100	

Based on Table 6, out of 21 elderly with first-grade hypertension, 57.1% of them had mild cognitive function impairment, while another 42.9% had a decrease in severe cognitive function. Of the 17 elderly with second-grade hypertension, it was found that 82.4% of them experienced a decrease in severe cognitive function and another 17.6% experienced a decrease in mild cognitive function impairment.

The results of chi-square statistical test analysis showed P-value = 0.013 (P < 0.05) which means that there was a significant relationship between the degree of hypertension and the occurrence of decreased cognitive function (MMSE) in the elderly.

Table 6: Relationship between the degree of hypertension with mild and severe cognitive function impairment (using MMSE) in elderly

Variable		Cognitive function impairment (MMSE)		Total	P – value
		Mild n %	Severe n %	n %	
Hypertension	Grade 1	12 57.1	9 42.9	21 100	0.013
	Grade 2	3 17.6	14 82.4	17 100	
Total		15 39.5	23 60.5	38 100	

In the assessment of cognitive function using AMT instrument, the results of the analysis with chi-square statistical analysis obtained was a value of P = 0.078 (P > 0.05) which means that there was no significant relationship between the degree of hypertension and the decreased cognitive function in the elderly.

Table 7: Relationship between the degree of hypertension with cognitive function impairment using AMT in elderly

Variable		Cognitive function (AMT)		Total	p-value
		Normal n %	Disturbed n %	n %	
Hypertension	Grade 1	22 59.5	15 40.5	37 100	0.078
	Grade 2	7 35	13 65	20 100	
Total		29 50.9	28 49.1	57 100	

In the assessment of cognitive function using the 6-CIT instrument, the results of the chi-square statistical test analysis were obtained by P = 0.027 (P < 0.05) which means that there was a significant relationship between the degree of hypertension and the cognitive function impairment in the elderly.

Table 8: Relationship between the degree of hypertension with cognitive function impairment using 6-CIT in elderly

Variable		Cognitive function (6-CIT)						p-value
		Normal		Mild cognitive impairment		Severe cognitive impairment		
		n	%	n	%	n	%	
Hypertension	Grade 1	15	40.5	61	6.2	15	40.5	0.027
	Grade 2	4	20	00		16	80	
Total		19		61	0.5	31	54.4	

Discussion

Hypertension is still a health problem both in developed and developing countries. Hypertension can cause various complications, and one of the complications is impaired cognitive function, which can certainly interfere with everyday life. In this study, the number of hypertensive patients who were sampled as many as 57 people and the sample in this study was obtained through the visit of the Karya Kasih Nursing Home Medan, Indonesia.

In this study, elderly classified into three categories; elderly (60-74 years), old (75-90 years), and very old age (90 years and over) [12]. In this study, the age range of subjects was 75-90 years who had the most cognitive dysfunction (79.4%) (Table 2). The results of this study showed the same results with the research of Qian He et al., (2016) in the Binhai New Area in Tianjin, China which examined cognitive impairment had subjects with a mean age of 76 years [13]. Similar research conducted by Taraghi et al., (2016) in four Mazandaran University Teaching Hospitals, Iran was concerned cognitive function disorders in elderly with chronic heart failure with a mean age of 70 years in the middle-aged category [14].

The results of this study found that male patients consisted of 18 people (31.6%) and female patient consisted of 39 people (68.4%) (Table 1). The elderly group of women experienced more impaired cognitive function (71.8%) compared to male elderly (56.6%) (Table 3). This is showed the same result with the research conducted by Wreksoatmodjo (2014) found that women are more likely to suffer from cognitive dysfunction, especially at very advanced ages, given that women have longer life expectancies [15]. Men are found to have cognitive impairment at a younger age; this is due to the presence of cardiovascular disease which is more common in men [16].

In this study, there was a significant relationship between the history of hypertension for more than five years compared with less than five years (p = 0.003) (Table 4). The results of research conducted by Pandean and Surachmanto (2016) obtained significant results between the duration of hypertension and cognitive function disorders [17]. Other studies conducted by Tuo Li, et al., (2014) concerning the relationship of the duration of hypertension and changes in cognitive function in hypertensive patients [18]. The study found significantly in the group who had a long history of hypertension. This situation occurs due to the narrowing and sclerosis process of the small arteries in the subcortical region, which results in hypoperfusion, loss of autoregulation, decreased brain barrier, and eventually subcortical white matter demyelination, microinfarction and cognitive impairment. MRI examinations in patients with chronic hypertension often showed subcortical lesions, microinfarcts, astrogliosis, ventricular dilatation, and extracellular fluid accumulation compared to those without hypertension [19].

Research which conducted by Reitz, et al., (2007) concluded that the history of hypertension was associated with a risk of mild cognitive impairment, and a stronger relationship was seen in non-nephritis-type mild cognitive impairment compared with amnestic. The results of this study also showed that the prevention and treatment of hypertension could have a strong effect in reducing the risk of cognitive impairment [20].

This study found a significant relationship between the degree of hypertension and cognitive function disorders using the MMSE method (p < 0.05) (Table 5) and more patients with second grade hypertension experienced severe cognitive impairment (82.4%), and there were relationships that significant between the degree of hypertension and mild and severe cognitive dysfunction (p = 0.013). This is similar with the studies in India on cognitive function at the age of 60 years as measured by MMSE also shows that in hypertensive respondents the average total MMSE score and score for orientation, attention-calculation, immediate memory, and language (except registration) is significantly lower [21]. The duration of hypertension also affects the decline in cognitive function. In Waldstein and Katzel's (2001) study, patients who suffer from hypertension for more than 5 years can affect their cognitive function [22]. This results in reduced memory and the ability to think in old age. This can occur because large blood vessels (carotid arteries) that supply it to the brain and small blood vessels in the brain are also affected by hypertension. Hypertension causes damage to the endothelium of the cerebral artery. This damage can cause interference in the blood brain barrier, so that toxic substances can easily enter the brain. Moreover, the blood vessel damage can decrease blood supply to the brain, give raise to atherosclerosis in large arteries

and blockade of arterioles. In the end, this process causes damage to the white matter that plays a role in the transmission of messages from one brain region to another, also causes a mini stroke or often called silent infarction because the symptoms that appear are not clearly visible. In patients with hypertension who take medicines found damage to white matter is not as great as in patients without taking anti-hypertensive drugs, and also in patients whose blood pressure is uncontrolled, extensive damage is seen. In the final stage of hypertension, it is found that there is atrophy or shrinkage in the brain mass. These various disorders gradually lead to vascular disease in the brain, which in the final stage causes cognitive impairment [23].

The community study found that the prevalence of mild to severe cognitive dysfunction around 17-34% in the elderly population. This cognitive function impairment is related to several factors, including neurological disease, vascular disease, depression and diabetes mellitus [24].

Measurement of cognitive function with the 6-CIT instrument in the elderly also gave the same significant relationship with MMSE between the degree of hypertension and impaired cognitive function (p = 0.027). In this study, there was a significant reduction in second-grade hypertension (80%) compared to first-grade hypertension (40.5%) (Table 8).

This result is different from using the instrument for assessing cognitive function, namely AMT, in the elderly. In this study, there was no significant relationship between the degree of hypertension and impaired cognitive function (p = 0.078) (Table 7). This is because AMT has a lower sensitivity and specificity compared to MMSE. The AMT instrument contains 10 questions and can be used as a screening whereas to get more detailed used the MMSE instrument. Based on the results of this study, it can be concluded that there was a relationship between the history or duration and degree of hypertension with cognitive dysfunction in the elderly at the Karya Kasih Nursing Home Medan.

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