Conference Paper

Risk Factors for Cognitive Impairment after Ischemic Stroke

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Abstract

Stroke can cause cognitive impairment. Cognitive impairment is brain function disorder that includes impaired orientation, attention, concentration, memory, language and intellectual functions. The aim of this research was to analyze the risk factors for cognitive impairment after ischemic stroke based on risk factors such as age, gender, educational level, record of hypertension, exposure to cigarette smoke, medication adherence, and sleep pattern in ischemic stroke patients in Hajj General Hospital Surabaya. This study is an observational analytic study with case control design. Respondents consisted of 38 cases and 38 control selected through accidental sampling. Data were obtained from questionnaires named Mini Mental State Examination (MMSE) questionnaire and the Pittsburg Sleep Quality Index (PSQI) questionnaire. The independent variables in this study are age, gender, educational level, record of hypertension, exposure to cigarette smoke, medication adherence, and sleep pattern. The analysis in this study used OR calculation on Epi Info with significance level 95% CI. The results showed that cognitive impairments in post-stroke ischemic's risk are age (OR = 3,43; 95% CI = 1,08 < OR < 10,89), sex (OR = 2,67; 95% CI = 1.05 < OR < 6,83), educational level (OR = 4,17; 95% CI = 1,60 < OR < 10,86), record of hypertension (OR = 1,60; 95% CI = 0,62 < OR < 4,17), exposure to cigarette smoke (OR = 1,24; 95% CI = 0,50 < OR < 3,04), medication adherence (OR = 6,59; 95% CI = 2,23 < OR < 19,43), and sleep pattern (OR = 8,125; 95% CI = 2,88 < OR < 22,93). The research results showed that age, gender, level of education, medication adherence, and sleep pattern have a significant OR values and record of hypertension as well as exposure to cigarette smoke have insignificant OR values. Ischemic stroke patient is suggested to maintain medication compliance and sleep pattern.

Keywords: ischemic stroke, cognitive impairment, risk factors, demographic factors, vascular factors

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1. Introduction

Stroke is a brain disease in form of local or global nerve function disorders, which happens suddenly, progressively, and quickly. Stroke causes neurological disorders whose symptoms include facial paralysis, slurred speech, and stutter [1].

Currently, the prevalence of stroke in Indonesia is 12.1 per 1000 population. According to Riskesdas, the prevalence of stroke in 2007 was only 8.3%. Stroke is the leading cause of death in most hospitals in Indonesia at 14.5%. The highest prevalence of stroke based on nakes diagnosis and the symptoms are found in South Sulawesi (17.9%), Yogyakarta (16.9%), Central Sulawesi (16.6%), and East Java (16) [1].

Stroke can cause disruption both physically and psychosocially. One disorder due to stroke is cognitive impairment. The percentage of cognitive impairment in patients with stroke is 17-38% [2]. Cognitive impairment due to stroke include impaired attention, orientation, memory, and thinking [3].

Cognitive function is intended to show a one's ability to learn, receive, and manage information from the surrounding environment. Brain damage is a factor that affects cognitive function, resulting in manifestation of impaired cognitive function. Damage to the left and right hemispheres results in different symptoms because of a process of lateralization of certain functions to one hemisphere (cerebral dominance). Damage to the left hemisphere causes language, reading, writing, counting, verbal memory, and motor skills disorders. Damage to the right hemisphere causes visuospatial (perception), visuomotor, visual memory, motor coordination disorders, and neglect [4].

Cognitive disorder is brain damage in the form of impaired orientation, attention, concentration, memory and language as well as intellectual function whose symptoms include disruption in numeracy, language, semantic memory (words) and problem solving. Stroke increases the risk for cognitive function decline by 3 times [5].

In the United States, it is estimated that there are approximately 500,000 cases of new or recurrent strokes each year and currently there are approximately 4 millions post-stroke patients experiencing sequelae in form of neuropsychological symptoms [6]. The risk of cognitive impairment in patients with stroke increases with age and the highest risk is at age 75 years [7].

cognitive impairment after stroke is associated with long-term survival that leads to quality of life (Health-related Quality of Life), which is the impact of cognitive impairment and disorders in other functions that can interfere daily activities and often cause dependence to others, as well as decline in productivity [8].

Studies showed that stroke can cause cognitive impairment. Cognitive impairment can be measured with MMSE (mini-mental state examination) and the results show the declining value in one or more dominants [9].

2. Materials and Methods

This study is an analytic observational study using case control design. The aspects examined in this study are risk factors, namely age, sex, education level, record of hypertension, exposure to cigarette smoke, sleep pattern, and medication adherence in cognitive impairment after ischemic stroke.

The study was conducted at Hajj General Hospital, Surabaya. The population of case group in this study was patients with cognitive impairment at one to two years after ischemic stroke. While the population of control group in this study was patients without cognitive impairment at one to two years after ischemic stroke. The sample size of case group was 38 ischemic stroke patients. The sample size of control group was 38 ischemic stroke patients. The sampling in this study was non-probability sampling with accidental sampling technique.

The instruments for data collection were questionnaire on respondents' data, Mini Mental State Examination (MMSE) questionnaire to measure cognitive function, and the Pittsburg Sleep Quality Index (PSQI) questionnaire to measure sleep quality and sleep pattern.

The technique of data analysis used in this study was odds ratio (OR) in Epi Info version 7.2.1.0 with a significance level of 95% Confidence Interval to measure the risk factors for cognitive impairment after ischemic stroke.

3. Results

The research subjects aged > 55 years were as many as 58 people (76.32%) and as many as 18 people (23.68%) were aged ≤ 55 years. The proportion of stroke patients aged > 55 years with cognitive impairment was 56.90% and the one without cognitive impairment was 43.10%. The proportion of ischemic stroke patients aged ≤ 55 years with cognitive impairment was 27.78% and stroke patients aged ≤ 55 years without cognitive impairment was 72.22%. The OR value obtained from the risk calculation was 3.43 with 95% CI = 1.08 < OR < 10.89, indicating that OR is significant and that ischemic stroke patients aged > 55 years have 3.43 times greater risk for cognitive impairment than ischemic stroke patients aged ≤ 55 years (Table 1).

Among the research subjects, as many as 33 people (43.42%) were female and as many as 43 people (56.58%) were male. The proportion of female stroke patients with cognitive impairment was 63.64% and the one without cognitive impairment was 36.36%. The proportion of male stroke patients with cognitive impairment was

Table 1: Demographic characteristics of ischemic stroke patients.

Variables	Cognitive Impairment		Total	OR 95% CI
	Yes (n = 38)	No (n = 38)		
Age				OR = 3.43 1.08 < OR < 10.89
41–55 years	5	13	18	
56–78 years	33	25	58	
Sex				OR = 2.67 1.05 < OR < 6.83
Female	21	12	33	
Male	17	26	43	
Level of education				OR = 4.17 1.60 < OR < 10.86
Elementary School–Junior High School	26	13	39	
Senior High School and higher	12	25	37	

39.54%, and the one without cognitive impairment was 60.46%. The OR value obtained from the risk calculation was 2,67 with 95% CI = 1,05 < OR < 6,83, indicating that OR is significant and that female ischemic stroke patients have 2.67 times greater risk for cognitive impairment than male ischemic stroke patients (Table 1).

A total of 39 people (51.32%) of the research subjects completed basic education (elementary school-junior high school) and 37 people (48.68%) completed advanced education (senior high school and higher). The proportion of stroke patients who completed basic education with cognitive impairment was 66.67% and the one without cognitive impairment was 33.33%. The proportion of stroke patients who completed advanced education with cognitive impairment was 32.43% and the one without cognitive impairment was 67.57%. The OR value obtained from the risk calculation was 4.17 with 95% CI = 1.60 < OR < 10.86, indicating that OR is significant and that patients with ischemic stroke with basic education level have 4.17 times greater risk for cognitive impairment than ischemic stroke patients with advanced education level (Table 1).

Out of 76 research subjects, 50 people (65.79%) had record of hypertension and 26 people (34.21%) did not have record of hypertension. The proportion of stroke patients with record of hypertension with cognitive impairment was 54% and the one without cognitive impairment was 46%. The proportion of stroke patients who did not have a history of hypertension who had cognitive impairment was 42% and those without

cognitive impairment were 58%. The OR value obtained from the risk calculation was 1.60 with 95% CI = 0.62 < OR < 4.17, indicating that OR is insignificant and that record of hypertension is not associated with cognitive impairment after ischemic stroke and not a risk factor for cognitive impairment after ischemic stroke (Table 2).

Table 2: Risk value of cognitive impairment after ischemic stroke based on state of hypertension.

Record of Hypertension	Cognitive Impairment		Total	OR 95% CI
	Yes (n = 38)	No (n = 38)		
With record of hypertension	27	23	50	OR = 1.60 0.62 < OR < 4.17
Without record of hypertension	11	15	26	

Research subjects exposed to cigarette smoke were as many as 40 people (52.63%) and those who were not exposed to cigarette smoke were as many as 53 people (47.37%). The proportion of stroke patients exposed to cigarette smoke with cognitive impairment was 52.5% and the one without cognitive impairment was 47.5%. The proportion of stroke patients not exposed to cigarette smoke with cognitive impairment was 47.22% and the one without cognitive impairment was 52.78%. The OR value obtained from the risk calculation was 1.24 with 95% CI = 0.50 < OR < 3.04, indicating that OR is insignificant and that cigarette smoke exposure is not associated with cognitive impairment after ischemic stroke and not a risk factor for cognitive impairment after ischemic stroke (Table 3).

Table 3: Risk value of cognitive impairment after ischemic stroke based on cigarette's smoke exposure.

Exposure to Cigarette Smoke	Cognitive Disorders		Total	OR 95% CI
	Yes (n = 38)	No (n = 38)		
Exposed	21	19	40	OR = 1.24 0.50 < OR < 3.04
Not exposed	17	19	36	

Research subjects with normal sleep pattern were as many as 34 people (44.74%) and those with abnormal sleep pattern were as many as 42 people (55.26%). The proportion of stroke patients with abnormal sleep pattern with cognitive impairment was 71.43% and the one without cognitive impairment was 28.57%. The proportion of stroke patients with normal sleep pattern with cognitive impairment was 23.53% and the one without cognitive impairment was 76.47%. The OR value obtained from the risk analysis was 8,125 with 95% CI = 2,88 < OR < 22,93, indicating that OR is and that

ischemic stroke patients with abnormal sleep pattern have 8,125 times greater risk for cognitive impairment than ischemic stroke patients with normal sleep pattern (Table 4).

Table 4: Risk value of cognitive impairment after ischemic stroke based on sleep pattern.

Sleep Patterns	Cognitive Impairment		Total	OR 95% CI
	Yes (n = 38)	No (n = 38)		
Abnormal	30	12	42	OR = 8,125 2.88 < OR < 22.93
Normal	8	26	34	

Research subjects with medication adherence were as many as 49 people (64.47%) and those without medication adherence were as many as 27 people (35.53%). The proportion of stroke patients without medication adherence with cognitive impairment was 77.78% and the one without cognitive impairment was 22.22%. The proportion of stroke patients with medication adherence with cognitive impairment was 34.70% and the one without cognitive impairment was 65.31%. The OR value obtained from the risk analysis was 6.5 9 with a 95% CI = 2,23 < OR < 19.43, indicating that OR is significant OR and that ischemic stroke patients without medication adherence have 6,59 times greater risk for cognitive impairment than ischemic stroke patients with medication adherence (Table 5).

Table 5: Risk value of cognitive impairment after ischemic stroke based on medication adherence.

Medication Adherence	Cognitive Impairment		Total	OR 95% CI
	Yes (n = 38)	No (n = 38)		
Adherent	21	6	27	OR = 6.59 2.23 < OR < 19.43
Not adherent	17	32	49	

4. Discussion

Age is a risk factor for cognitive impairment after ischemic stroke in accordance with reported studies [10–13]. A stroke that occurs in to an elderly may increase the risk of cognitive impairment than the one occurs to a younger person. This is due to other cerebrovascular pathology in the elderly's brain that may occur because of stroke that one had ever suffered from or diseases other than ischemic stroke [14].

Women have a greater risk for cognitive impairment because of the role of endogenous sex hormone level in changes in cognitive function. Low level of estradiol in the body is associated with decreased general cognitive function and verbal memory. Estradiol is thought to be neuroprotective and can limit damage due to oxidative stress and is regarded as protector of nerve cells from amyloid toxicity in patients with cognitive impairment [15]. These results are in accordance with the results of research conducted by Knopman et al. [13] and Desmond et al. [16].

Level of education is a risk factor for after ischemic stroke cognitive impairment. The higher the level of education can increase tolerance for the incidence of cognitive impairment in stroke patients [17]. According to Evans et al. [18], education can improve skills and strategies of problem solving so as to reduce the incidence of cognitive impairment after ischemic stroke.

Exposure to cigarette smoke is not a risk factor for cognitive impairment after ischemic stroke. It is in contrary to previous studies that have been conducted [19, 20]. Nicotine in cigarettes will react in the brain in 10 seconds after inhaling cigarette smoke. Nicotine will bind to nicotinic receptors that facilitate the release of adrenergic neurotransmitters, this process is important in cognitive function, memory, alertness, and reducing appetite [19]. This may occur because exposure to cigarette smoke is one of the risk factors of ischemic stroke. Therefore, most ischemic stroke patients in the study are exposed to cigarette smoke.

Record of hypertension is not a risk factor for cognitive impairment after ischemic stroke. The results of this study correspond with previous studies [21, 22]. Results of previous studies were not consistent with the research conducted by Arntzen et al. [23]. The process of cognitive decline in people with hypertension begins with pathological changes in the blood vessels of the brain. Pathological changes in the brain will cause abnormalities in the brain vessels. Abnormalities and damage to the brain vessels will lead to an increased risk for cognitive impairment [23, 24].

The association between sleep disorders and risk factors for vascular disease such as stroke has been well documented but not widely known. Sleep disorders may contribute to vascular pathology through direct and indirect mechanisms. The consequences of sleep disorders that are not treated immediately leads to cognitive impairment and a slow stroke rehabilitation process [25].

Medication adherence is a risk factor for after ischemic stroke cognitive disorders. According to Glader et al. [26], medication adherence in stroke patients is often poor, 50% of patients discontinue treatment for up to two years after stroke. According to

Mellon et al. [27], medication adherence is a secondary prevention to the incidence of cognitive impairment in post-stroke patients.

5. Conclusion

Demographic factors which are risk factors for cognitive impairment after ischemic stroke are age > 55 years, female, and basic education. Other factors that increase the risk cognitive impairment after ischemic stroke are abnormal sleep pattern and non-adherent to medication.

The results of this study indicate that sleep pattern and medication adherence are factors to be controlled as an effort to prevent one of the effects of ischemic stroke namely cognitive impairment. Therefore, preventive measures such as counseling and early detection of cognitive impairment are necessary. Results of the study are used as input to the hospital in making poster, leaflet, or a pocket book on healthy lifestyles of stroke patients to avoid severe cognitive impairment in order to improve the quality of life of stroke patients.

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