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Original Research Article

Association of the atherosclerosis, small vessel disease, cardioembolism, other causes with the executive function of the montreal cognitive assessment Indonesia in patients with post ischemic stroke

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ABSTRACT

Background: ASCO Phenotype classification is a new classification of stroke based on phenotypic system. ASCO classification can evaluate the etiology of ischemic stroke comprehensively to characterize patients using different grade of evidence for the subtype of ischemic stroke. ASCO classification can predict post ischemic stroke cognitive decline. This Study purpose to evaluate the association between ASCO classification with the executive function in post ischemic stroke patients.
Methods: This cross sectional study followed by 28 post ischemic stroke patients (men 16, women 12) over 3 months. Mean age 52.82±8.66. Cognitive function was assessed by Montreal Cognitive Assessment Indonesia (MoCA INA).
Results: There were 17 patients with grade 1 atherosclerosis (ASCO A1), ten patients with grade 1 small vessel disease (ASCO S1), one patient with grade 1 cardioembolism (ASCO C1) in post ischemic stroke. Grade 1 atherosclerosis (ASCO A1) was significantly associated with executive function decline (p=0.002), naming decline (p=0.05), abstraction decline (p=0.001), memory decline (p=0.002) and orientation decline (p=0.016)). Grade 1 small vessel disease (ASCO S1) was significantly associated with executive function decline (p=0.001) and memory decline (p = 0.001) and abstraction (p=0.001). Grade 1 cardioembolism 1 (ASCO C1) was not significantly associated with cognitive decline.
Conclusions: There was significant association between ASCO classification with the executive function of Montreal Cognitive Assestment Indonesia (MoCA INA) in post ischemic stroke patients.

Keywords: ASCO, Executive function, MoCA INA, Post ischemic stroke

INTRODUCTION

Stroke is the second most common cause of death in the world after ischemic heart disease and is a cause of physical impairment and impaired cognitive function. More than half of patients experience permanent physical disability and two-thirds will experience it for five years after a stroke.The prevalence of impaired cognitive function in post-stroke patients is 30-50% and occurs immediately after a stroke.[1]

The aetiology of ischemic strokes is often multifactorial so the classification of ischemic strokes must include all pathological abnormalities most likely to be the cause of ischemic stroke. The two classifications of ischemic stroke currently used are phenotypic and causative classifications. Phenotypic classification records all abnormal findings from all tests performed and classifies them according to the degree of severity of certain values

of evidence. The phenotypic classification will determine the degree of each possible etiology of ischemic stroke. The phenotypic classification consists of Atherosclerosis, Small Vessel Disease, Cardioembolism, Dissection (ASCOD), Atherosclerosis, Small Vessel Disease, Cardioembolism (ASCO), Causative Classification System (CCS) and Baltimore-Washington. This classification is ideal for large-scale epidemiological and genetic studies.

The causative classification establishes ischemic stroke patients with one single category based on clinical, epidemiological and diagnostic data.This classification usually depends on the criteria by looking at ischemic stroke risk factors in a variety of different conditions in population-based studies. Patients were classified into a single, exclusive category that reduced the number of ischemic stroke subtypes. Causative classification consists of Trial of Org 10172 in Acute Stroke Treatment (TOAST), CCS and Chinese Ischemic Stroke Subclassification (CISS).[2,3]

The right classification for stroke based on the mechanism of the cause of stroke is important to determine stroke management and prognosis. The main etiology of stroke differs according to race or ethnicity. Cardiac embolism or extracranial large vessel atherosclerosis is the most common cause of ischemic stroke in Western countries while small blood vessel occlusion or intracranial vascular atherosclerosis is the most common cause in Asian countries. Intracranial atherosclerosis often causes strokes due to occlusion of arterial branches and usually the degree of stenosis is <50%. Mild intracranial stenosis can cause embolization of the distal region if the atherosclerotic plaque is quite fragile. Magnetic resonance imaging (MRI) can identify plaques that can cause infarction even in patients with a normal vascular picture.Some cases that are often found in Asia cannot be classified as large arterial atherosclerosis according to existing classifications. Further efforts to make ischemic stroke classifications in several studies that have been carried out can better know the mechanism of the cause of stroke, especially in patients with single subcortical infarction and intracranial atherosclerosis.[4]

Disorders of post-stroke cognitive function often occur in patients who have suffered a stroke. The prevalence of post-stroke cognitive function disorders ranges from 20% to 80%, varying based on differences between countries, tribes and diagnostic criteria. The risk of post-stroke cognitive function disorders is related to demographic factors such as age, education, work and vascular factors.

The exact mechanism underlying the occurrence of post-stroke cognitive impairment is not yet known but lesions are based on neuroanatomy in strategic areas such as the hippocampus and white matter lesions (WMLs), cerebral microbleeds (CMBs) associated with cerebrovascular small vessel disease contributing to the pathogenesis of impaired cognitive function. Handling of post-stroke cognitive disorders other than anti-dementia drugs, also by dealing with the underlying cerebrovascular disease.[5]

Risk factors associated with impaired cognitive function in ischemic stroke were previous cerebrovascular abnormalities of 74.5%, atrial fibrillation of 63.9%, carotid stenosis of 61.8%, small blood vessel occlusion of 42.9% and stroke which is the result of other specified causes of 30.8%. The subtypes of post circulation stroke have the most significant relationship to the occurrence of cognitive function disorders of 53.7%. The most extensive domain of cognitive function disorders in post-stroke patients is recall and visuospatial executive functioning in the first 6 months after stroke.[1]

In a study by Douri et al, the prevalence of cognitive function disorders after 3 months post-stroke was 22% and there was no increase in prevalence up to 5 years after stroke. A significant progressive cause of impaired cognitive function after stroke is small blood vessel occlusion and lacunar infarction by 10% for 5 years after stroke. The amount of cognitive impairment can have a significant impact on quality of life and daily activities of life by reducing the level of individual independence after a stroke and is associated with long-term morbidity and disability.[6]

In the study of Tuladhar et al, there was a relationship between SVD and memory disorders ($p = 0.016$). SVD including hyperintense white matter (WMH) and lacunar is usually associated with impaired cognitive function and dementia in older people.Cognitive disorders in subjects with cerebral artery disease are related to structural microintegrity of some WMH that connects different cortical and subcortical regions.[7]

Atrial fibrillation as the etiology of cardioembolic stroke has a direct relationship with cognitive function. Not only is it associated with impaired cognitive function but also acts as a cause of rapid decline in cognitive function and the development of dementia at a young age. There is evidence to support that atrial fibrillation causes cognitive impairment. But not all cognitive impairment domains are affected. The domains of cognitive function affected are abstract thinking, immediate and delayed recall and executive functions. Atrial fibrillation is associated with an increased risk of thromboembolism through several mechanisms, among others, due to vascular stasis and hypercoagulation status. Several studies have shown increased plasma fibrinogen levels in patients with chronic atrial fibrillation without the presence of heart valve disease, cardiac dysfunction and coronary artery disease. Patients with atrial fibrillation and dementia show an increase in thrombin formation and fibrin changes compared with no dementia. Other supporting factors of procoagulant/protrombotic are local cardiac platelet activation and endothelial dysfunction in atrial fibrillation of acute onset.[8]

METHODS

The objective of the present study is to assess the relationship between ASCO phenotype classification and executive function in post-ischemic stroke patients.

This cross-sectional study was conducted in the Department of Neurology of Faculty of Medicine of University of North Sumatra/Central General Hospital of Haji Adam Malik of Medan from June 2017 to April 2018. The research subjects were taken from the population of outpatients in the Neurology Polyclinic of the Central General Hospital of Haji Adam Malik Medan. Determination of research subjects was carried out according to consecutive non-random sampling method with a total sample of 28 patients. The inclusion criteria were all patients with more than 3 months post-ischemic stroke with full awareness who had undergone supportive examinations to be classified according to the ASCO phenotype classification and give approval to participate in research. All post-ischemic stroke patients over 3 months had been classified according to ASCO phenotype classification. All ischemic strokes were confirmed by imaging studies. Ischemic stroke was grouped, and the degree was determined by the classification of the ASCO phenotype.[3] In this phenotype-based classification, each patient is characterized by the ASCO system (A for atherosclerosis, S for small vessel disease, C for cardiac source, and O for other causes). Each of the 4 phenotypes is given degrees 0, 1, 2 or 3 according to their severity. ASCO phenotype classification determination for the degree of atherosclerosis (A), the patient performed a transcranial doppler (TCD) examination, for the degree of small vessel disease (S) head computed tomography scan (head Ct scan) and magnetic resonance imaging (MRI) was examined, for the degree of cardiac source (C), patient was examined by head computed tomography scan, electrocardiography and echocardiography and for other sources (O) with a complete blood tests. Then the research subjects were examined the cognitive function by using Montreal Cognitive Assessment Indonesia (MoCA Ina). Exclusion criteria were post-ischemic stroke patients with right hemiparesis, patients with schizophrenia, patients with aphasia, patients who had previously experienced dementia, and recurrent ischemic stroke patients. Statistical analysis was carried out using SPSS for Windows with the Pearson Chi-Square correlation.

RESULTS

Of the 28 research subjects analyzed, there were 16 (51.7%) males and 12 (42.9%) females. The mean age of post-ischemic stroke patients was 52.82±8.66 years. Subjects came from different tribes with the majority being Batak of 15 (53.6%). The work of the majority of the subjects was housewives, namely as many as 10 (35.7%) subjects. Most subjects fall into the age group of 51-60 years, i.e. as many as 10 (35.7%) subjects. Education of most subjects was graduated from high school seniors, is as many as 12 (42.9%) subjects. The most frequent risk factor was hypertension in 12 subjects (42.9%), followed by hypercholesterolemia in 6 subjects (21.4%), smoking in 4 subjects (14.3%), coronary heart disease in 3 subjects (10.7%), diabetes mellitus in 2 subjects (7.1%), and no risk factors for 1 subject (3.5%) (Table 1).

Table 1: The characteristics of research subjects.

Subject Characteristics, n = 28	
Age (Year), mean±SD	52.82±8.66
Sex	
Male	16 (51.7%)
Female	12 (42.9%)
Age	
31-40 years	2 (7.14%)
41-50 years	9 (32.1%)
51-60 years	10 (35.7%)
61-70 years	7 (25%)
Occupation	
Housewife	10 (35.7%)
Retired	3 (10.7%)
Farmer	2 (7.1%)
Trader	4 (14.3%)
Government employee	6 (21.4%)
Driver	1 (3.6%)
Teacher	1 (3.6%)
Self-employed	1 (3.6%)
Education	
Primary School	4 (14.3%)
Junior High School	2 (7.1%)
Senior High School	12 (42.9%)
3-Year Diploma	6 (21.4%)
Bachelor (S-1)	4 (14.3%)
Risk Factors	
Hypertention	12 (42.9%)
Hypercholesterolemia	6 (21.4%)
Smoking	4 (14.3%)
Coronary heart disease	3 (10.7%)
Diabetes mellitus	2 (7.1%)
Stroke Duration	
3 months-6 months	8 (28.6%)
7 months-1 year	7 (25%)
1 year-3 years	13 (46.4%)

In post-ischemic stroke patients, ASCO A1 was found in 17 subjects, ASCO S1 in 10 subjects and ASCO C1 in 1 subject, and no ASCO O1 was found (Table 2).

From the MoCA Ina examination, the impairments of executive functions were found in 71.4%, memory in 71.4%, abstraction in 67.9%, attention in 28.6%, language in 17.9%, orientation in 14.3 %, and naming in 10.7% (Table 3).

Table 2: Overview of ASCO classification in post-ischemic stroke patients.

ASCO classification degrees	n (%)
ASCO A1	17 (60.7%)
ASCO S1	10 (35.7%)
ASCO C1	1 (3.6%)
ASCO O1	0

ASCO: Atherosclerosis, Small vessel disease, Cardiac source, Other source

Table 3: Overview of impaired cognitive functions in post-ischemic stroke patients.

Impaired cognitive function	n (%)
Executive function	71.4 %
Naming	10.7 %
Attention	28.6 %
Language	17.9 %
Abstraction	67.9 %
Memory	71.4 %
Orientation	14.3 %

From the examination it was found that the mean scores of executive functions were 2.46±1.13, naming was 2.61±0.68, attention was 4.07±1.84, language was 2.17±1.02, abstraction was 0.92±0.61, memory is 1.64±1.22, and orientation is 5.14±1.07 (Table 4).

Table 4: Overview of mean cognitive function scores in post-ischemic stroke patients.

Cognitive function	Mean±SD
Executive function (0-5)	2.46±1.13
Naming (0-3)	2.61±0.68
Attention (0-6)	4.07±1.84
Language (0-3)	2.17±1.02
Abstraction (0-2)	0.92±0.61
Memory (0-5)	1.64±1.22
Orientation (0-6)	5.14±1.07

In ASCO A1, a significant decrease was found in executive functions (p = 0.002), naming (p = 0.05), abstraction (p = 0,001), memory (p = 0.002), and orientation (p = 0.016). In ASCO S1, a significant decrease was found in executive function (p = 0.001), memory (p = 0.001), and abstraction (p = 0,001). In ASCO C1 a significant relationship was not found to impaired cognitive function (Table 5).

Table 5: Relationship of ASCO 1 classification with cognitive functions.

Asco	Executive function (%)		Naming (%)		Attention (%)		Language (%)		Abstraction (%)		Memory (%)		Orientation (%)	
	I	NI	I	NI	I	NI	I	NI	I	NI	I	NI	I	NI
ASCO A1	71.4	28.5	71.4	28.5	28.5	71.4	17.5	82.1	67.8	32.1	71.4	28.5	75	25
P-value	0.002		0.05		0.671		0.353		0.001		0.002		0.016	
ASCO S1	67.8	32.1	10.7	89.2	28.5	71.4	17.8	82.1	32.1	67.8	85.7	14.2	14.2	85.7
P-value	0.001		0.533		1.000		1.00		0.001		0.001		0.116	
ASCO C1	100	0	100	0	100	0	100	0	100	0	100	0	100	0
P-value	1.000		0.143		0.286		0.179		1.000		1.000		0.143	

I-Impaired, NI-Not impaired, Pearson Chi-Square Test, p<0.05

DISCUSSION

In this study it was found that ischemic strokes classified according to ASCO can help in assessing cognitive function with what domains are most disturbed. In this study ASCO A1, was significantly associated with executive functions (p = 0.002), naming (p = 0.05), abstraction (p = 0.001), memory (p = 0.002), and orientation (p = 0.016). This is in line with the research by Romero et al. that shown that carotid stenosis ≥25% was associated with low executive function (p = 0.002). Carotid stenosis ≥50% is also associated with low executive function (p = 0.02).[9] In the subclinical atherosclerosis and 20-year cognitive decline study: The Atherosclerosis Risk in Communities (ARIC), and the neurocognitive study by Love et al. 2011-2013 it was found that 4099 individuals with atherosclerosis experienced decreased executive function (Beta = -0.05, 95% CI: -0.08, -0.02).[10]

In this study ASCO S1, is significantly associated with executive function (p = 0.001), memory (p = 0.001) and abstract impairments (p = 0.001). This is in line with the research by Carey et al that found a significant relationship between the total number of lacunar infarcts and decreased executive function (β = - 0.222; P = 0.046). This study shows that subcortical ischemic vascular disease (SIVD) in the form of silent lacunar infarction produces executive function disorders where it is consistent with the hypothesis that SIVD disconnects frontal-subcortical circuit relationships.[11]

In this study there was no significant relationship between ASCO C1 and executive function disorders with p = 1.000 (p>0.05). In Washida et al, there was a significant a decrease in executive function was found in 65 patients with cardioembolic stroke with non-valvular AF with an average executive function score of 2.8 (1.4).[12] This study has limitations where when data

collection was carried out, only one sample with ASCO C1 was found outpatient to the neurology polyclinic,so even though on a neurological examination, in patients with ASCO C1 the disorder was found in almost all cognitive functions but did not have a significant relationship.

Stroke and cognitive decline pose a big threat to the elderly people. The PSCI includes all forms of cognitive decline that develop after a stroke, even if it is not severe enough to fit the criteria for post-stroke dementia.The actual cognitive burden due to stroke may be underestimated because cognitive decline due to stroke is 3 times more common than in non-stroke subjects. PSCI significantly worsens the survival rate of patients even compared to patients with alzheimer's disease. However, there is usually not much attention given to cognitive decline after a stroke.[12]

Cerebral small vessel disease (SVD) is the most common pathological cause of dementia and is a major cause of various severity of VCI. Radiological features are lacunar infarction, with or without a large area of the hyperintense white matter which is also called leucoaraiosis. Other features are brain atrophy and cerebral microbleeds. Cognitive damage in the SVD is characterized by a decrease in executive function, processing speed, and episodic memory. A recent hypothesis explains that damage to white matter can cause impairment in the white matter tract, and the breakdown of connections between cortical-subcortical and cortical-cortical, which underlie complex networks associated with cognitive control mechanisms and the process of receiving information.[13]

CONCLUSION

This study shows that there is a significant relationship between the etiology of ischemic stroke based on ASCO phenotype classification. Atherosclerosis is associated significantly with executive function, naming, abstraction, memory and orientation. On the small vessel disease is associated significantly with a decrease in executive function, memory and abstraction is found. In cardioembolism, decreased function is found in almost all domains of cognitive function.

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REFERENCES

1. Mellon L, Brewer L, Hall P, Horgan, Williams D, Hickey A, et al. Cognitive impairment six months after ischemic stroke: a profile from the ASPIRE-S study. BMC Neurology. 2015;15:31.
2. Radu RA, dan Terecoasa EO. Clinical Neurology and Neurosurgery. Elsevier. 2017;159:93-106.
3. Amarenco P, Bogousslavsky J, Caplan LR, Donnan GA, Hennerici MG. New Approach to Stroke Subtyping: The A-S-C-O (Phenotypic) Classification of Stroke. Cerebrovascular Diseases. 2009;27:502-8
4. Kim JB, Kim SJ. Ischemic stroke subtype classification: an Asian viewpoint. J Stroke. 2014;16(1):8-17.
5. Sun HJ, Tan L, and Yu TJ. Post stroke cognitive impairment: epidemiology, mechanism and management. Ann Trans. Med. 2014;2(8):80.
6. Douri A, Rudd AG, Wolfe ADC. Prevalence of post stroke cognitive impairment. Stroke. 2013;44:138-45.
7. Tuladhar AM, Norden AG, Laat AF, Zwiers MP, Dijk E, Norris D, et al. White matter integrity in small vessel disease is related to cognition. Neuroimage. 2015;7:518-24.
8. Shah DA, Merchant MF, Delurgio BD. Atrial fibrillation and risk of dementia/cognitive decline. Journal of Atrial Fibrillation. 2016;8(5):53-60.
9. Romero RJ, Beiser A, Seshadri S, benjamin E, Polak FJ, Vasar SR, et al. Carotid artery atherosclerosis, mri indices of brain ischemia, aging, and cognitive impairment. Stroke. 2009;40:1590-6.
10. Love SA, Palta P, Kalbaugh C, Sharret A, Gross AL, Alonso A, et al. Subclinical atherosclerosis and 20-year cognitive decline: The Atherosclerosis Risk in Communities (ARIC). Neurocognitive study. Circulation. 2015;131:A47.
11. Carey LC, Kramer HJ, Josepshon Mungas D, Reed RB, Schuff N, et al. Subcortical Lacunes are associated with executive. Stroke. 2008;39:397-402.
12. Washida K, Ihara M, Tachibana H, Sekiguchi K, Kowa H, Kanda F, et al. Association of the ASCO classification with the executive function subscores of the montreal cognitive assessment in patients with post-ischemic stroke. J Stroke Cerebrovascular Dis. 2014;23(1):2250-5.
13. Lawrence JA, Patel B, Morris GR, Mackinnan DA, Rich MP, Barrick RT. Mechanism of cognitive impairment in cerebral small vessel disease: Multimodal MRI result from the St. George Cognitive and Neuroimaging in Stroke (SCANS) study. Plos One J. 2013;8(4):1-5.

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