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Research Article

Cognitive Function Differences based on Hemispheric Lesions of First-Ever Ischemic Stroke Patients

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Abstract: Ischemic stroke is one of stroke subtype often correlated with disturbance of cognitive function. We conduct an observational study with cross-sectional design of 70 ischemic stroke patients. Objective of this study is to evaluate cognitive differences based on hemispheric lateralization lesions. We used Montreal Cognitive Assessment – Indonesian version (MoCA-Ina) to assess cognitive function resulting on 70 patients, consist of 48 subjects (68.57 %) of left hemispheric stroke and 22 subjects (31.43%) of right hemispheric stroke. As much as 68 subjects (97.14 %) are categorized as having cognitive disturbance. Mean differences of MoCA-Ina was assessed using Mann-Whitney test resulting no significant differences between left vs right hemisphere groups (18.94 ± 3.26 vs 19.82 ± 3.13; *p*= 0.320). Further study would warrant lesions lateralizations could affects cognitive performance of ischemic stroke patients.

Keyword: ischemic stroke, cognitive, hemisphere, lateralization

Introduction

Stroke , especially ischemic stroke is one of the most disabling cerebrovascular disease and could interfere with the subject cognitive function. While for first stroke it usually happened in one of the carotid circulation of cerebral hemispheric region, excepts for vertebrobasilar circulation stroke, even first stroke could resulting in permanent cognitive deficits. While it has been conservatively recognized that cognitive performance was dominated by left hemisphere and any disturbance of it would interfere one's cognitive ability, recent study shows that several cognitive domain, such verbal and visuospatial ability is also influenced by right brain hemispheres as the process is a result of commissural interaction between both hemisphere and its degree of lateralization between right and left region of the brain.[1,2]

In 2008, Leśniak et al conclude that the most frequently affected subdomain was attention (48.5%), language (27%), short term memory (24.5%) and executive function (18.5%), while these cognitive subdomain which could be measured overall using Montreal Cognitive *Assesment* (MoCA).[3] Firstly developed by Nasreddine and Cummings in 2000, MoCA today has widely used and has been transculturally adapted in Indonesia, known as MoCA Indonesian Version (MoCA-Ina).[4,5] Comparable with Mini Mental State Examination (MMSE) previous neuropsychological battery, MoCA-Ina show wider range of cognitive assessment including executive and visuospatial task and less confounder bias such subject's educational background[6], though there are still debatable that MoCA's high sensitivity followed by low specificity of the test.[6,7] Our study try to elaborate if there is any differences in cognitive performance of first ever stroke side lesion using MoCA-Ina tool.

Materials and Methods

Ethical approval received from the Health Research Ethical Committee, Faculty of Medicine Universitas Sumatera Utara, Medan-Indonesia. From July to November 2017, we acquired 70 consecutive samples of first ever hemispheric ischemic stroke outpatients on Neurology Clinic of Adam Malik General Hospital proved by previous head CT expertise. Exclusion criteria of this study including patients with history of dementia pre cerebrovascular accident, patients with posterior circulation stroke, patients that cannot speak Bahasa Indonesia, partial or total blindness, severe deafness and patient with major psychiatric liabilities, inculuding psychotic and depression. Informed consent was asked from the patients (or their legal responders by any means the patients cannot give consent).

First we note site of the infarct by evaluating Head CT result of the patients and also the radiologist's expertise. Then we used MoCA-Ina tool to evaluate all subjects fulfilling the inclusion criteria. As for the Moca-Ina validation, we use cutoff score of < 26 to define cognitive disturbance.[4,5,6] Data were collected and calculated using IBM SPSS Statistic for Windows and test of normality was conducted using Kolmogorov-Smirnov and furthered being compared using Mann-Whitney Test.

Results

This study has recruited for as much as 70 patients of first-ever ischemic stroke patients of carotid circulation which cause either left or right hemispheric infarcts. Furthermore, the sample divided overall subjects onto 2 main groups, the left and right hemispheric stroke. Characteristic of subjects is shown in table 1.

Table 1 Characteristics of Subjects

Variables	n (%)
Age	
< 55 y.o	28 (40.00 %)
56 – 65 y.o	38 (54.30 %)
>66 y.o	4 (5.70 %)
Sex	
Male	39 (55.70 %)
Female	31 (44.30 %)
Ethnicity	
Bataknese	33 (47.14 %)
Padangnese	19 (27.14 %)
Javanese	18 (25.72 %)
Education	
Elementary School	4 (5.71 %)
Middle School	20 (28.57 %)
High School	30 (42.86 %)
Bachelor Degree	16 (22.86 %)
Occupation	
Public Employment	27 (38.57 %)
Private Employment	17 (24.29 %)
Unemployment	26 (37.14 %)
Hemispheric Lesion	
Left Hemisphere Stroke	48 (68.57 %)
Right Hemisphere Stroke	22 (31.43 %)
Total	70 (100 %)

Using the forementioned cutoff value of MoCA-Ina above, we found that 68 subjects (97.14%) were showing cognitive decline while 2 subjects (2.86 %) still achieved MoCA-Ina Score $\geq$ 26. Cross tabulation of MoCA-Ina score of the subject shown in Table 2.

Table 2 Cross Tabulation of MoCA-Ina Score of Total Subjects

MoCA-Ina Score	Hemisphere Lesion		Total Subjects
	Left	Right	
Cognitive Declined	2	0	2
12	2	1	3
14	3	0	3
15	4	3	7
16	4	2	6
17	4	3	7
18	12	3	15
19	2	0	2
20	5	0	5
21	2	3	5
22	6	5	11
23	0	2	2
24			
Non-Cognitive Decline			
26	1	0	1
27	1	0	1

While MoCA-Ina score means differences between 2 groups calculated using Mann-Whitney test and shown in Table 3.

Table 3 MoCA-Ina Score Differences on Left and Right Hemisphere Stroke

	Total	Left Hemisphere Stroke (n = 48)	Right Hemisphere Stroke (n = 22)	p
MoCA-Ina Score Mean Differences ($\pm$ SD)	19.21 $\pm$ 3.23	18.94 $\pm$ 3.26	19.82 $\pm$ 3.13	0.320 *

*Mann-Whitney Test

Discussion

Post stroke cognitive impairment has been recognized as one of contributing condition caused by vascular remodelling, also known on term as vascular cognitive impairment and has been a burden in brain degeneration nowadays.[8] While we aware that many previous study have manage to correlate and compare cognitive disturbance in post stroke patients, we also think that this study is important in our society as quoted from research by Narasimhalu et al which stated that post stroke cognitive impairment could be predictor of post stroke severity and mortality.[9]

From the cross-tabulation of the data using MoCA- Ina with cutoff score of 26, we found that 68 subjects (97.14 %) of the sample are diagnosed with post stroke cognitive impairment. The high number percentage somehow comparable with study done by Lestari et al in Jakarta, that found 72.41 % of the post stroke sample subject has cognitive problems regarding other confounding factor such as ischemic stroke risk factor dan ethnic biodiversity of the subjects between these studies.[10]

Using Mann-Whitney test, we compared MoCA-Ina score's mean differences in between left and right hemispheric stroke, resulting in 18.94 $\pm$ 3.26 vs 19.82 $\pm$ 3.13, respectively, unfortunately not statistically significant (p = 0.320). This left-lateralization-associated deterioration is in line with previous study done by Chan et al, which also compared left sided vs right sided stroke resulting in MoCA-Ina raw score of 15.17 $\pm$ 6.89 vs 18.80 $\pm$ 7.38.[11] These two study results are understandable considering left brain damage would causing general cognitive impairment unless exclusive cognitive domain impairment such visuospatial and attentional domain.[2,11] This is considered as a weakness of this study that did not elaborate as per domain score. Another confounding factor also found on undocumented risk factor of the subject, as any vascular compromise could also become bias in cognitive performance.

CONCLUSION

Left-sided first ischemic stroke resulting in lower MoCA-Ina score's mean differences compared to right-sided ones, but not statistically significant (18.94 $\pm$ 3.26 vs 19.82 $\pm$ 3.13, p =

0.320). Further study with risk factor estimation and larger sample is encouraged to provide better viewpoint regarding other confounding variables.

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