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Original Research Article

Correlation between acute ischemic stroke onset with Alberta stroke program early CT score

Iskandar Nasution[1]*, Khairul Putra Surbakti[1], Netty Delvrita Lubis[2], Etiya Ekayana[1]

[1]Department of Neurology, [2]Department of Radiology, Faculty of Medicine, Universitas Sumatera Utara / Haji Adam Malik General Hospital, North Sumatra, Indonesia

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***Correspondence:**
Dr. Iskandar Nasution,
E-mail: iskandarnstsps@yahoo.com

ABSTRACT

Background: Alberta Stroke Program Early CT Score (ASPECTS) is a valid method for assessing early ischemic changes in the middle cerebral artery from a CT scan of patient with acute ischemic stroke. One of the factors that influence ASPECTS is stroke onset time, where a very subtle level of hypodensity in early onset can provide poor reliability on ASPECTS assessments. Aim of the study was to determine the relationship between the onset of acute ischemic stroke and ASPECTS.
Methods: This study used a cross-sectional design with Chi-Square method in patients with acute ischemic stroke and anterior circulation stroke treated in The Stroke Corner and Integrated Ward of Haji Adam Malik General Hospital during the months of February - May 2019. All patients were evaluated for ASPECTS and stroke onset at admission. Stroke onset was divided into 3 parts: Under 24 hours, 24 - <48 hours and 48-72 hours. ASPECTS value was assessed by 2 observers. Authors categorized the ASPECT value into 2 groups: Low (≤7) and High (>7).
Results: Among 36 patients with Acute Ischemic Stroke, mean age was 55.7±13.9 years old, which male and female shares equal number by 18 persons (50%). Mean ASPECTS score was 7.2±2.0. This research found 5 patients (13.9%) with less than 24 hours onset and low ASPECTS score, 3 patients (8.3%) with 24 - <48 hours onset and low ASPECTS score, 7 patients (19.4%) with 24 - <48 hours onset and high ASPECTS score, 8 patients (22.2%) with 48-72 hours onset and low ASPECTS score, and 2 patients (5.6%) with 48-72 hours of onset and high ASPECTS score. Valuation of ASPECTS from both observers was considered as excellent (statistic K value = 0.9).
Conclusions: ASPECTS has a significant relationship with stroke onset (p=0.029) and the initial ischemic change will be seen more clearly with increasing stroke onset time.

Keywords: Alberta stroke program early CT score, Ischemic stroke, Stroke onset

INTRODUCTION

Stroke is a disease that has become a global health problem, a major cause of mortality and disability worldwide.[1] Acute Ischemic Stroke occurs as a result of sudden occlusion in vascular parts of the brain, and mostly manifested as a focal neurological deficit. Expenditures made by Stroke patients worldwide reached $ 70 billion per year and strikes significant effect to patients and caregivers' quality of life.[2]

According to World Health Organization (WHO), 30% of total deaths worldwide were caused by heart disease and stroke. Every year there were about 795.000 stroke patients in The United States; an average of every 40 seconds a person experiences Stroke, and an average of every 4

minutes someone dies from Stroke. About 60% of those deaths occurs outside proper hospital treatment.[3,4]

Computed Tomography (CT) scan is currently the main modality for imaging patients with acute stroke. Although Magnetic Resonance Imaging (MRI) is a modality that can provide better information about the ischemic infarction process, most stroke patients come to public hospitals that does not have MRI facilities.[5] The Alberta Stroke Early CT Score (ASPECTS) program is a valid, robust, and reliable method for assessing the rate of early ischemic changes (hypo-attenuation of focal parenchyma, loss of gray-white differentiation and sulcal depletion) on CT scans in patients with acute ischemic stroke. ASPECTS is designed to measure the rate of initial ischemic changes in the area of the middle cerebral artery on brain CT scans.[6]

Factors affecting ASPECTS include stroke onset time, acquisition technique and CT scan slice thickness. The initial ischemic change will be seen more clearly with increasing stroke onset time, where in the first 90 minutes, the level of hypodensity is so subtle that it can provide poor reliability.[7]

METHODS

This is a descriptive analytic study with cross sectional design with the source of data obtained from acute ischemic stroke patients in The Stroke Corner unit and Integrated Ward (RINDU) ward A section 4, Department of Neurology, Haji Adam Malik General Hospital. The research was conducted during the months of February - May 2019. The research sample was taken from the population of ischemic stroke patients who were treated in The Stroke Corner unit and RINDU ward A section 4. Determination of the amount of sample was using non-consecutive Random Sampling Method. All acute ischemic stroke patients were established based on history taking, physical examination, and head CT scan.

Inclusion criteria

- Patients with acute ischemic stroke and patients with anterior circulation stroke who had been examined for Head CT Scan and treated in The Stroke Corner unit and The RINDU A4 ward at Haji Adam Malik General Hospital Medan and accepted to participate in this research.

Exclusion criteria

- Patients with recurrent ischemic stroke and wake-up stroke. The dependent variable in this study is the onset of the ischemic problem. The dependent variable was ASPECTS.

The number of samples obtained that met the inclusion and exclusion criteria were 36 samples. The onset of stroke was divided into 3 parts: Under 24 hours, 24 - <48 hours, 48-72 hours. ASPECTS value was assessed by 2 group of observers: the researchers and a consultant radiologist.

The MCA region was divided into 10 ASPECTS regions; caudate (C), insular ribbon (I), posterior horn of internal capsule (IC), lentiform nucleus (L), inferior anterior frontal cortex (M1), anterior temporal cortex (lateral of insular ribbon; M2), posterior temporal cortex (M3), superior anterior MCA cortex (ACA-MCA boundary zone; M4), posterior frontal cortex (M5), parietal cortex (M6). For involvement in the ASPECTS region, the value is reduced by 1 point from a total score of 10, so the lower score indicates greater infarction. The division of 10 ASPECTS regions is shown in Figure 1.[5,7]

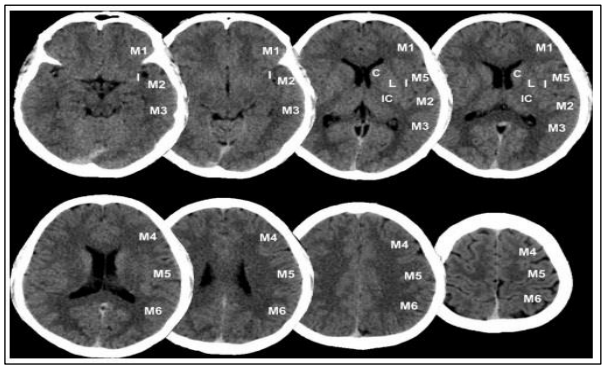

Figure 1: Division of the aspects region.

To determine the relationship between the onset of acute ischemic stroke with ASPECTS, a Chi-Square method analysis was conducted using a software of IBM SPSS (Statistical Product and Science Service) version 22, Microsoft Windows version. It was stated that the relationship between variable was significant if p value <0.05.

RESULTS

The sample of this study involved 36 acute ischemic stroke patients seeking treatment at Haji Adam Malik General Hospital Medan. Data distribution of demographic characteristics from research subjects found that patients consisted of 18 men (50.0%) and 18 women (50.0%). The mean age of the subjects of this study was 55.7±13.9 years.

The majority of subjects' level of education was Senior High School (33.4%). Most subjects were self-employed (36.1%). Highest ethnicity group are Karo (36.2%). Most subject level of consciousness was compos mentis (88.9%). The majority of stroke onset in this study was 12-24 hours (33.4%). The average value of ASPECTS is 7.2±2.0. The mean value of mRS after 14 days of stroke onset was 2.6±1.3. Demographic characteristics are seen in Table 1.

Chi-square test results showed a significant relationship between the onset of ischemic stroke and ASPECTS (p =

0.029) in Haji Adam Malik General Hospital Medan. From Table 2 it can be seen that the longer the delay of ischemic stroke onset, the more of increase in patients with low ASPECTS score.

Table 1: Demographic characteristics of research subjects (n=36).

Variable		N (36)	%
Gender	Male	18	50. 0
	Female	18	50. 0
Age, mean±SD		55.7±13. 9	
Level of education	Elementary school	8	22. 2
	Junior high school	8	22. 2
	School senior hight	12	33. 4
	College graduate	8	22. 2
Ethnicity	Karo	13	36. 2
	Batak	8	22. 2
	Java	7	19. 4
	Minangnese	3	8. 3
	Mandailing	5	13. 9
Level of consciousness	Compos mentis	32	88. 9
	Apathy	1	2. 8
	Somnolence	3	8. 3
Stroke onset	<24 hours	16	44.4
	24- <48 hours	10	27.8
	48-72 hours	10	27.8
Average aspects value±sd		7.2±2.0	

Table 2: Relationship of stroke onset with ASPECTS.

Stroke onset	Aspects		p
	Low (≤7)	High (>7)	
<24 hours	5	11	0.029
24 - <48 hours	3	7	
48-72 hours	8	2	

DISCUSSION

Demographic data from this study shown that 36 ischemic stroke patients consists of 18 male patients (50%) and 18 female patients (50%). That was aligned to Rambe et al research of stroke patients in 25 hospitals located in North Sumatra, where ratio of male and female patients were equal.8 In Zanzmera et al, research, male patients had 62% higher risk to suffer stroke compared to female.[6]

The mean age of the subjects of this study was 55.7±13.9 years, younger than the average age of the patients studied by Corso et al, in 2014 which was 75.7±12.7 years.[9] This is also consistent with the study of Zanzmera et al in 2012 which the average age of research subjects was 58.8±16.9 years.[6] Most of the education levels of the subjects from this study were Senior High Schools which reached 33.4%, and most subjects were self-employed (36.1%). The most ethnic group found in this research subjects is Karo tribe (36.2%). Most of the level of awareness of research subjects when entering hospital was compos mentis which reached 88.9% of all subjects. The majority of stroke onset in this study was under 24 hours (44.4%). Early ischemic changes can be seen on CT scans obtained in the first few hours after the onset of stroke, which is a result of early cytotoxic edema that may develop into irreversible injuries. With increasing stroke onset time, the initial ischemic change will be seen more clearly.[6]

In a study conducted by Godwin et al, there is no head CT scan abnormalities was present when the onset of stroke is less than 3 hours. Only about 7.2% of patients present with cerebral infarction images after 6 hours of onset of symptoms. In addition, the study showed as many as 57 (68.7%) patients presents head CT scan abnormalities after more than 12 hours of onset.[10] The average value of ASPECTS in this study was 7.2±2.0. This is consistent with Khan et al study in 2017, where the average value of ASPECTS was 7.1±0.3. In this study, among 66 patients (73.0%) that achieved high ASPECTS scores, most of them had good clinical outcomes (69.0%).[9] ASPECTS has a cutoff of >7 and ≤7, where patients with high ASPECTS scores (8-10) accompanied with low infarct volume at initial imaging show the best clinical results.[11]

In this study the number of patients with onset under 24 hours, obtained a low ASPECTS value of 5 (13.9%) patients and a high ASPECTS value of 11 (30.6%) patients. While at 24- <48 hours of onset the low ASPECTS value was 3 (8.3%) patients and the high ASPECTS value was 7 (19.4%) patients. At the onset of 48-72 hours, with low ASPECTS values in 8 (22.2%) patients and high ASPECTS values in 2 (5.6%) patients.

This study however has its own limitations, among others, it did not compare the value of ASPECTS to stroke severity. It also did not assess the posterior circulation stroke. Further research needs to be done to determine changes in CT scan images based on the onset of ischemic stroke.

CONCLUSION

ASPECTS has a significant relationship with stroke onset (p=0.029) and the initial ischemic change will be seen more clearly with increasing stroke onset time.

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