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ABSTRACT

Background:

Stroke, particularly ischemic stroke, is one of the world, Indonesia, and Yogyakarta's most prevalent non-communicable disease, as well as a major cause of morbidity and mortality in the population. There were many studies which aimed to obtain new information regarding acute ischemic stroke, specifically stroke severity, due to its parallel association with post-stroke outcome. Previous studies also focused on SGOT/SGPT ratio, specifically due to the role of the enzymes in pathophysiology of stroke and how it is associated with patients' functional outcome, which indicate its possible role in determining severity of stroke.

Objective:

To study the association between elevation of SGOT/SGPT ratio and stroke severity, assessed using NIHSS score, in acute ischemic stroke patients hospitalized in RSUP Sardjito Yogyakarta.

Method:

A secondary data-based, observational analytical study using retrospective cross-sectional design which utilises data from acute ischemic stroke patients admitted to RSUP Dr. Sardjito Yogyakarta's stroke unit between January 2020 - December 2023. The obtained data is analyzed using univariate, bivariate, and multivariate analyses in order to obtain information regarding the association between SGOT/SGPT Ratio and stroke severity in the subjects, with considerations regarding selected confounding variables.

Result

The research found that elevation of SGOT/SGPT is significantly associated with a moderate-severe degree of stroke severity (p-value: 0.006; OR: 4.549 (1.615 – 12.814)). Other than SGOT/SGPT ratio, 5 confounding variables (smoking; BUN; stroke history; LDH; DM) were also significantly associated with stroke severity. However, SGOT/SGPT's association with stroke severity is not independent since it is made insignificant by presence of LDH, revealed by bivariate analysis between the two variables (p-value: 0.007).

Conclusion

It is concluded that SGOT/ SGPT ratio possess a significant association with stroke severity in AIS patients. However, this association is not a completely independent association since it is affected by presence of LDH, a confounding variable found to be significantly associated with stroke severity.

Keyword:

Acute Ischemic Stroke, Serum Glutamic Pyruvic Transaminase, Serum Glutamic Oxaloacetic Transaminase, SGOT/SGPT ratio, Stroke Severity, NIH Stroke Scale

CHAPTER I

INTRODUCTION

1.1 Study Background

Stroke is one of the world's most prevalent non-communicable disease. World Stroke Organization (WSO) 2022's global stroke fact sheet stated that stroke affected over 101 million individuals worldwide with 12.2 million new cases recorded every year (Feigin et al., 2022). Out of all the newly recorded stroke cases in 2022, 62% were ischemic stroke cases and 38% were hemorrhagic stroke cases (Feigin et al., 2022). Stroke is also a major health burden globally, responsible for causing approximately 6.5 million mortalities and over 143 million healthy life years lost worldwide every year in 2022 (Feigin et al., 2022).

Analogous with its position in global health, stroke is likewise a prevalent health issue and major health burden in Indonesia. Based on the Indonesian ministry of health's 2018 *Riskesdas,* national prevalence of stroke in Indonesia was 10.9 cases per thousand (Balitbangkes Kemenkes RI, 2019a). Age-sex standardized mortality and DALYs (Disability-adjusted Life Years) lost attributable to stroke of Indonesia were 193.3 deaths per 100.000 population and 3,382.2 years lost per 100.000 population (Venketasubramanian et al., 2017). Identical to its national status, stroke is also a prevalent health issue and burden in Special Region of Yogyakarta. Based on data from 2018's *Riskesdas*, prevalence of stroke in Yogyakarta province was 14.6 cases per thousand, higher than the national stroke prevalence of 10.9 cases per thousand (Balitbangkes Kemenkes RI, 2019b).

Stroke severity is an important aspect in the study of stroke, especially for predicting post-stroke outcome (Phan et al., 2017 ; Rost et al., 2016). Previous studies have established that stroke severity are consistently connected to both short- and long-term post-stroke outcomes (mortality and disability) (Gaughan et al., 2017; Johnston et al., 2003; König et al., 2008; Koton et al., 2013; Saver and Altman, 2012). Degree of stroke severity, measured using NIHSS score, was found to be paralelly related to degree of functional outcome, as assessed using modified Rankin Scale (mRS) (Wouters et al., 2018). In AIS patients. There are various biomarkers believed to be associated with degree of stroke severity in AIS patients. Notable examples of the studied biomarkers include Serum Glutamic Oxaloacetic Transaminase (SGOT) and Serum Glutamic Pyruvic Transaminase (SGPT).

SGOT and SGPT are enzymes which constitute the majority of liver transaminases (Moriles and Azer, 2022). SGOT and SGPT levels could also be presented in form of SGOT/SGPT ratio which possesses threshold for normal, acceptable, value (Botros and Sikaris, 2013). In relation to how SGOT/ SGPT ratio is possibly connected to stroke severity, it could be directly related to the enzymes' role in glutamate metabolism, an excitatory amino acid (EAA). The concentration of glutamate, which is interrelated with concentration of SGOT and SGPT, was found to be directly proportional with upon-hospitalization neurological deficit in acute ischemic stroke (Castillo et al., 1996). Previous studies were also able to discover information that level of the SGOT and SGPT enzymes, which influence the SGOT/SGPT ratio, are connected towards outcome in stroke patients (Campos et al., 2011a; Gao et al., 2017; Ahmadabad et al., 2022; Xu et al., 2022). However,

the studies were yet to be able to establish a clear relationship between the two variables, whether they are inversely or parallelly connected in nature.

Based on the previously mentioned information, it could be concluded that stroke is an ever-growing non-communicable disease which possess high prevalence and significant health burden within the global, national, and local community. Post-stroke recovery is an outcome desired to be achieved by patients and healthcare providers, and its attainment could be predicted through the degree of stroke severity. In order to understand stroke severity better, multiple studies were performed throughout the world to study variables which may correlate to stroke severity in cases of AIS, one of them being SGOT/SGPT ratio. In Indonesia, there are currently very few researches which study the relationship between SGOT/SGOT ratio and stroke severity in AIS patients. Consequently, this study aims to contribute towards the establishment of the relationship between elevation of SGOT/SGPT ratio and stroke severity in acute ischemic stroke patients.

1.2 Problem Formulation

Based on the information obtained from the study background, below are the problems identified from the matter:

a. Stroke is one of Indonesia's and Yogyakarta's most prevalent health issue

b. Stroke is a major cause of mortality and disability in Indonesia

c. Serum levels of GOT and GPT were found to influence concentration of glutamate, which affect stroke severity in acute ischemic stroke patients

d. Serum levels of GOT and GPT were discovered to be correlated with degree of functional impairment in AIS patients post–hospitalization, which is associated with degree of stroke severity

e. There were very few studies regarding how serum levels of GOT and GPT associate with stroke severity of acute ischemic stroke patients in Indonesia

1.3 Research Question

Is there any association between elevated SGOT/SGPT ratio and stroke severity in acute ischemic stroke patients.

1.4 Research Objective

a. General Objective

Identify presence of possible association between elevated SGOT/SGPT ratio and stroke severity in acute ischemic stroke patients.

b. Specific Objective

1) Know the amount of AIS patients hospitalized in RSUP Dr. Sardjito Yogyakarta between 2020 - 2023 with elevated SGOT/SGPT ratio

2) Know the degree of stroke suffered by AIS patients hospitalized in RSUP Dr. Sardjito Yogyakarta between 2020 - 2023, as measured using National Institute of Health Stroke Scale (NIHSS)

1.5 Research Authenticity

Table 1. Research Authenticity

No.	Title	Author	Research Design	Results
1.	Neuroexcitatory Amino Acids and Their Relation to Infarct Size and Neurological Deficit in Ischemic Stroke	(Castillo et al., 1996)	Cross-sectional study	High concentration of excitatory amino acids (glutamate and glycine) were associated with higher degree of stroke severity, which was measured in accordance to degree of infarction and neurological deficit
2.	High Blood Glutamate Oxaloacetate Transaminase Levels are Associated with Good Functional Outcome in Acute Ischemic Stroke	(Campos et al., 2011a)	Prospective Cohort	High level of Glutamate Oxaloacetate Transaminase (GOT) in blood is associated with good ranli in acute ischemic stroke patients
3.	Neuroprotection by Glutamate Oxaloacetate Transaminase in Ischemic Stroke: an Experimental Study	(Campos et al., 2011b)	Randomized Controlled Trial	Intravenous administration of oxaloacetate 3.5 mg/ 100 g, aimed to induce activation of SGOT, was able to induce reduction of glutamate concentration, infarct size, tissue edema, and motor deficit
4.	De Ritis Ratio (AST/ALT) as an Independent Predictor of Poor Outcome in Patients with Acute Ischemic Stroke	Gao et al., 2017	Retrospective Cohort	Elevation of De Ritis ratio at admission of Acute Ischemic Stroke patients is significantly associated with poor outcome at 3 months
5.	Evaluation of De Ritis (AST/ALT), ALP/ALT, and AST/ALP ratios as Prognostic Factors in Patients with Acute Ischemic Stroke	Ahmadabad et al., 2022	Retrospective Cohort	Elevation of De Ritis ratio in acute ischemic stroke patients is associated with poor outcomes at 3 months
6.	Aspartate Aminotransferase to Alanine Aminotransferase Ratio and Clinical Outcomes after Acute Ischemic Stroke: the CNSR-III Registry	Xu et al, 2022	-	Elevation of AST/ALT ratio is correlated to higher risk of all-cause mortality and poorer functional outcome in patients with history of AIS/ Transient Ischemic Attack (TIA)

There are significant differences between this study and the other studies included in the literature review. This study, titled "Association Between Elevation of SGOT/SGPT Ratio and Stroke Severity of Acute Ischemic Stroke Patients in RSUP Dr. Sardjito Yogyakarta", is a secondary data-based clinical study, which makes it different in terms of type of research from (Campos et al., 2011b). This study utilises a cross-sectional study design, unlike the other studies listed in this section, except for (Castillo et al., 1996) which also utilized the same design. Regarding the population used in this study, this study utilizes acute ischemic stroke patients hospitalized in RSUP Sardjito Yogyakarta between January 2020 - December 2023. Any of the aforementioned studies did not gather data from this specific population.

The combination of independent and dependent variables of this study are also different from any of the studies listed in the table above. The independent variable, SGOT/SGPT ratio, was used by (Gao et al., 2017); (Ahmadabad et al., 2022); and (Xu et al, 2022) in identical capacity. However, in all of these past studies, SGOT/SGPT ratio was not paired with stroke severity as a dependent variable. In (Campos et al., 2011a), Serum level of GOT was instead used as independent variable rather than SGOT/SGPT ratio, making it different from this study.

The dependent variable of this study, stroke severity, was also used as dependent variable by (Castillo et al., 1996) and (Campos et al., 2011b). However, stroke severity in these two studies were not paired with SGOT/SGPT ratio as its independent variable. The instrument and parameter used for measuring stroke

severity is NIHSS score, which functions in clinical assessment of stroke severity degree. Other studies in the table above used different instrument to assess stroke severity clinically. Canadian Stroke Scale (CSS) was used in (Castillo et al., 1996), while mRS was utilized as the preferred tool in studies which had functional outcome as dependent variable (Ahmadabad et al., 2022; Gao et al., 2017; Xu et al., 2022).

Based on the explanation provided within the previous paragraphs, it could be concluded that the author's study is novel and different from any of the previous studies used for literature review.

1.6 Research Benefit

The results of this research are expected to provide benefits listed below:

1. Benefits for Institution

   Provide additional information and knowledge regarding the association between elevated SGOT/SGPT ratio and stroke severity in acute ischemic stroke patients.

2. Benefits for Knowledge and Science

   Contribute towards establishment of the relationship between elevated SGOT/SGPT ratio and stroke severity in acute ischemic stroke patients.