The Correlation between Random Glucose Levels and Stroke Severity Using the National Institutes of Health Stroke Scale (NIHSS) in Acute Ischemic Stroke Patients at RSUD dr. Harjono S Ponorogo

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Abstract. A common occurrence in acute stroke is elevated blood glucose levels, which not only represent the initial volume of infarcted brain tissue but also define the initial extent of infarction, functional capacity, and death in stroke patients. The objective of this observational analytic study with a cross-sectional design is to examine the link between random blood glucose levels and the severity of acute ischemic stroke in patients at RSUD Dr. Harjono S Ponorogo. The Stroke Patient Inpatient Room served as the site of the study. Consecutive sampling is used in this sample approach. The research tool examined respondents' baseline data from medical records, their diagnoses from random blood sugar tests, and their neurological abnormalities using the National Institute of Health Stroke Scale (NIHSS). There was no link between random blood glucose levels and neurological deficiency values, according to the findings of a correlation study utilizing the Spearman test between Random Blood Glucose Levels and NIHSS Values, obtained the results of the analysis of $p = 0.253$ (> 0.05), these results showed no correlation between random blood glucose levels and neurological deficit values. According to the study's findings, there is not enough proof that a patient's clinical outcome after an acute ischemic stroke can be predicted by random blood glucose levels. In order to predict the clinical fate of ischemic stroke patients in the acute phase, additional evaluation markers are required.

Keywords: Acute Ischemic Stroke, Random Blood Sugar, NIHSS

1 Introduction

WHO defines a stroke as a clinical symptom of reduced brain function that happens suddenly, lasts more than 24 hours, or persists until it results in death, and has no known cause other than vascular diseases. After ischemic heart disease, stroke is the second most frequent cause of death and disability worldwide. According to all stroke occurrences, ischemic strokes account for 87% of cases [1]. Ischemic strokes account for

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about 87% of strokes. About 75% of ischemic strokes are brought on by thrombotic strokes, which are cerebral artery blockages brought on by atherosclerosis, and 25% are caused by embolic strokes, which are cerebral artery blockages brought on by blood clots that have detached from other parts of the circulation [1].

Blood glucose levels that rise during the first 48 hours after an ischemic stroke have an impact on mortality and morbidity because they lead to lactic acidosis, which damages vascular, glial, and neuronal tissue. According to Kagansky [2], hyperglycemia increases the number of infarcts, lowers cerebral blood flow, leads to bleeding disorders, and damages the brain's blood-brain barrier. High blood glucose levels can also alter the brain's blood-brain barrier, worsen cerebral edema, block fibrinolysis, increase thrombosis, worsen bleeding problems, increase free radical production, and raise glutamate levels in the body [3].

2 Method

This study uses a cross-sectional design and observational analysis to examine the association between two variables. All stroke patients who received care at the RSUD Dr. Harjono S Ponorogo Stroke Inpatient Room between April and June 2022 comprised the study's population. The sample for this study included up to 50 patients who were receiving care at the RSUD Dr. Harjono S Ponorogo's Stroke Inpatient Room and had been diagnosed with an acute ischemic stroke. Non-experimental research falls under this category. This sampling method makes advantage of sequential sampling. Respondent data was taken from the medical records of all acute phase ischemic stroke patients who were treated at the Stroke Inpatient Room at RSUD Dr. Harjono S Ponorogo in the April-June 2022 period who met the inclusion criteria including: patients with a diagnosis of acute phase ischemic stroke and undergoing hospitalization at the Stroke Inpatient Room at RSUD Dr. Harjono S Ponorogo for 7 days or more.

The research instrument used medical records to look at respondents' baseline data, random blood glucose results and their medical diagnosis, and the National Institute of Health Stroke Scale (NIHSS) to assess neurological deficits[4]. Data is recorded in the research form. After that, data analysis was carried out with the Spearman correlation test. In addition, a bivariate analysis was performed using the chi-square statistical test to see the relationship between variables. The interpretation of the results has a significant correlation if the p value < 0.05.

3 Results And Discussion

3.1 Results

General data. Table 1 show the frequency distribution of general data of respondents at RSUD dr. Harjono’s Ponorogo in june – july 2022, 29 (58%) of the 50 responders were female and 21 (42%), males. The age range of 61–70 years accounts for 30 (60%) of the patients with acute ischemic stroke who are being treated at RSUD Dr. Harjono S Ponorogo. Housewives made up the majority of the 18 (36%) responders in the age distribution of patients with acute ischemic stroke who are being treated at RSUD Dr. Harjono S Ponorogo.

Table 1. Frequency Distribution of General Data of Respondents at RSUD Dr. Harjono S Ponorogo in June – July 2022

Characteristics	Frequency	%
Gender:		
Male	21	42
Female	29	58
Total	50	100
Age (years):		
40 - 50	9	18
51 - 60	5	30
61 - 70	30	60
> 70	8	16
Total	50	100
Occupational:		
Not working	9	18
Housewife	18	36
farmer	14	28
Trader	3	6
Private employees	6	12
PNS/TNI/POLRI	0	0
Total	50	100
Education:		
Not Schooling	14	28
Elementary School	13	26
Junior High School	6	12
Senior High School	17	34
College	0	0
Total	50	100

Source: primary data

The table above shows the distribution of education for acute ischemic stroke patients who are hospitalized at RSUD Dr. Harjono S Ponorogo was dominated by sufferers from the high school education group of 17 (34%) respondents.

Custom Data. Table 2 shows the history of diabetes mellitus in patients with acute ischemic stroke who are hospitalized at RSUD Dr. Harjono S Ponorogo by 10 (20%) respondents. Then, Table 3 show the frequency distribution of random sugar levels in patients with acute is-chemic stroke who are hospitalized at RSUD Dr. The highest Harjono S Ponorogo <110 by 19 (38%) respondents. Meanwhile, Table 4 shows the results of Respondents' NIHSS Scores at RSUD Dr. Harjono S Ponorogo highest <5 (mild) by 18 (36%) respondents and Table 5 show the Analysis of the Relationship of Random Sugar Levels with NIHSS Ratings.

Table 2. Frequency Distribution of Respondents' History of DM in RSUD Dr. Harjono S Ponorogo in June – July 2022

Diabetes Melitus History	Frequency	%
Ever	10	20
Never	40	80

Source: primary data

Table 3. Frequency Distribution of Random Blood Sugar Respondents at RSUD Dr. Harjono S Ponorogo in June – July 2022

Random Blood Sugar (mg/dL)	Frequency	%
<110	19	38
110 - 199	13	26
>199	18	36

Source: primary data

Table 4. Results of Respondents' NIHSS Scores at RSUD Dr. Harjono S Ponorogo in June – July 2022

NIHSS	Frequency	%
>25	9	18
14-25	10	20
5-14	13	26
<5	18	36

Source: primary data

Table 5. Analysis of the Relationship of Random Sugar Levels with NIHSS Ratings

			Sugar level	NIHSS Assessment
Spearman's rho	Sugar level	Correlation Coefficient	1.000	.253
		Sig. (2-tailed)	.	.077
		N	50	50
	NIHSS Assessment	Correlation Coefficient	.253	1.000
		Sig. (2-tailed)	.077	.
		N	50	50

*. Correlation is significant at the 0.05 level (2-tailed).

4 Discussion

The findings demonstrated that there was no correlation between changes in the NIHSS score and levels of ADD (p=0.253; p>0.05). The findings of this study disagree with a number of earlier investigations that discovered a connection between high GDA levels at hospital admission and poor ischemic stroke outcomes [5]. The discrepancies in the outcomes of this study could be due to changes in the research subjects' eligibility requirements, hyperglycemia definition, study design, statistical methodologies, and output measuring tools employed, making it impossible to compare the results of the investigations. On the other hand, the findings of this study are consistent with the findings of Iqbal et al. [6], who found no significant difference in the mean ADD levels in the outcome of acute ischemic stroke based on the Barthel Index. The level of the blood sugar measured by the GDA examination is derived from carbohydrate intake and various gluconeogenesis and glycogenolysis processes that take place in the body. These processes also take place during the acute phase of ischemic stroke as a result of the release of various catabolic hormones as a result of physiological stress conditions. After that, a condition known as stress-induced hyperglycemia, also known as hyperglycemia, is brought on by this process [7]. State that what is detrimental to the ischemic brain is the increase in blood sugar levels themselves, not the presence of blood sugar levels previously high.

Therefore, the research results that were not significant in this study could be caused by the blood sugar levels obtained through GDA examination which did not fully reflect the increase in blood sugar levels that occurred, where the high GDA levels at the time of admission to the hospital in research subjects could also be influenced by various factors. conditions before the ischemic stroke, including high carbohydrate intake, low physical activity, and pre-existing illnesses, especially DM, where these factors, except DM, were not investigated in this study. The participants in this study shared the same traits, including a history of diabetes mellitus (DM) and treatment aimed at reducing blood sugar levels during the acute stage of an ischemic stroke. These results confirm several earlier studies that found no significant association between blood sugar levels and outcomes in patients with a history of diabetes mellitus (DM) during the initial phase of ischemic stroke. This is because stress-induced hyperglycemia has less detrimental metabolic effects, fibrinolytic activity is not inhibited, and blood sugar-reducing medication plays a role in lowering the degree of lactic acidosis in DM patients. Additionally, the findings of this study that did not reach statistical significance may have been impacted by individual study subject variations in the severity of ischemic stroke. The size and location of the infarction, which were not examined in this study, can be used to determine how severe a stroke is. As seen by changes in the NIHSS score, the findings indicated that there was no correlation between nutritional status and acute ischemic stroke outcomes.

According to the study's findings, there is a substantial link between elevated glucose levels and the risk of stroke. When compared to patients who have good blood glucose management, patients with high blood glucose levels have a 1.5 times higher chance of having a stroke. Because it can worsen the cardiovascular system, cause thrombosis, increase inflammation, endothelial dysfunction, oxidative stress, and brain damage, hyperglycemia will have a negative impact on the patient's clinical outcome [8].

It is important to check blood glucose levels since neurological problems might be a clinical manifestation of hypoglycemia or hyperglycemia situations. Both stroke patients with and without a history of diabetes mellitus may experience hyperglycemia. Numerous factors contribute to the severity of ischemic stroke patients' outcomes when high blood sugar levels are present. The blood-brain barrier will shift as a result of hyperglycemia, along with cerebral edema and bleeding issues. Due to the buildup of lactic acid, hyperglycemia will also worsen acidosis, which will increase the production of free radicals, disrupt intracellular signal transduction, and activate endonucleases. Wider harm to brain tissue will result from this. Third, high blood sugar will cause the release of certain amino acids, particularly glutamate, which is crucial for activating postsynaptic glutamate receptors, particularly the NMDA (N-methyl-D-aspartate) receptor [9].

5 Conclusion

Based on the findings, random blood sugar levels and changes in the NIHSS score in acute ischemic stroke do not significantly correlate. The findings of this investigation support the conclusion that there is insufficient evidence to support the use of random blood glucose levels as a reliable predictor of the clinical outcome of patients with acute ischemic stroke. In order to better predict the clinical fate of ischemic stroke patients during the acute phase, more evaluation markers are required. Further investigation using primary data is required to determine the relationship between various blood sugar parameters, such as Random Blood Sugar, Fasting Blood Sugar, and HbA1c Examination, and the outcome of acute ischemic stroke in patients with and without a history of DM, considering the size and extent of infarction as well as complications that may develop in research subjects while undergoing treatment.

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