

The Relationship Between Type 2 Diabetes Mellitus and The Incidence of Acute Ischemic Stroke

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ABSTRACT

Background: Ischemic stroke is a cerebrovascular disease characterized by focal or global neurological deficits with clinical signs lasting 24 hours or more caused by disruption of blood supply to the brain. Stroke is the second leading cause of death in the world with 6.7 million deaths every year. The prevalence of stroke in Indonesia according to Riskesdas in 2018 reached 10.9%, namely around 2,120,362 people in Indonesia. Type 2 diabetes mellitus is a major risk factor for ischemic stroke. Data from the International Diabetes Federation (IDF) shows that in 2021 there will be 537 million cases of DM in adults aged 20-79 years, with an estimated increase to 643 million in 2030. With the estimated number of sufferers of type 2 diabetes mellitus continuing to increase, it can be concluded that ischemic stroke sufferers also continue to increase.

Methods: Observational analytic with cross-sectional design. Sampling was taken from medical record data at the Regional General Hospital. Dr. Chasbullah Abdulmadjid Bekasi City with a total of 87 patients who met the inclusion criteria

Results: The results of research conducted using Chi-Square Analysis showed that there was no significant relationship between type 2 diabetes mellitus and acute ischemic stroke with a P value of 0.698. The results of the

Pearson Chi-Square analysis and Fisher exact test accepted H0 and rejected H1 (there was no relationship).

Conclusions: There is no significant relationship between type 2 diabetes mellitus and the incidence of acute ischemic stroke

Keywords: Type 2 diabetes mellitus, Ischemic, Stroke

INTRODUCTION

Stroke is a health problem that is still a global concern. Stroke is the second leading cause of death in the world with a death rate of 6.7 million people every year [1]. The definition of stroke according to the World Health Organization is a condition characterized by the presence of focal or global neurological deficits with clinical signs that last for 24 hours or more and can cause death without any cause other than vascular [2]. In Indonesia, 28.5% of stroke patients die and the rest experience partial or total paralysis. Only 15% recover completely from stroke and disability [3]. The prevalence of stroke in Indonesia according to Riskesdas 2018 quoted from the article by Yusnita ED, et al (2022) reached 10.9%, namely around 2,120,362 people in Indonesia, the highest cases were at the age of ≥ 55 years (50.2%) and occurred more often in men (11%) than women (10%) [4].

Based on the cause, stroke is divided into two, namely ischemic stroke and

hemorrhagic stroke. Ischemic stroke is a disruption of blood flow in the brain due to blockage of blood vessels, ischemic stroke accounts for 85% of acute stroke incidents, while hemorrhagic stroke is a rupture of blood vessels in the brain, hemorrhagic stroke accounts for 15% of acute stroke incidents [5]. Classification of stroke subtypes ischemia that is often used in research is the Trial of ORG 10172 in Acute Stroke Treatment (TOAST) classification, namely (1) large vessel atherosclerosis, (2) cardioembolic, (3) lacunar, (4) other causes, and (5) causes unknown [6].

Ischemic stroke occurs in the brain when the blood supply is disrupted due to blockage of the brain's blood vessels. The blockage is fat deposits or plaque containing cholesterol in the blood. Blockages can occur in large blood vessels (carotid arteries); medium blood vessels (cerebral arteries); and small blood vessels. Blockages occur because the inner walls of the blood vessels (arteries) are thick and rough so that blood flow is not smooth and obstructed. Blood is a thick liquid, so blood clots (thrombosis) may occur, so that blood flow slows down and blood vessels become blocked. As a result, the brain lacks a blood supply that carries the necessary nutrients and oxygen [7].

Risk factors that can increase the incidence of ischemic stroke include non-modifiable risk factors, namely age, race, gender, and genetic factors. Meanwhile, factors that can be modified (modifiable risk factors) are a history of previous Transient Ischemic Attack or stroke, hypertension, smoking habits, dyslipidemia, and diabetes mellitus [8]. It is known that 30% of acute ischemic stroke patients have previously suffered from diabetes mellitus. Therefore, Diabetes mellitus is a major risk factor that can cause ischemic stroke. It was proven in research conducted by Antonious & Silliman in 2005 in the Journal of Northeast Florida Medicine that diabetes mellitus was a risk factor for stroke with a relative risk increase of 1.6 to 8 times. This is supported by research in the National Stroke Association journal which states that people with diabetes mellitus are 4

times more likely to have a stroke than those without diabetes mellitus [9].

According to the National Stroke Association (2018), diabetes hurts body tissue, causing increased fat deposits or clotting on the inside of blood vessel walls, and can accelerate the occurrence of atherosclerosis in small and large blood vessels, including blood vessels that supply the brain. The condition of atherosclerosis is very risky for experiencing blockages or rupture of blood vessels which can result in strokes [10].

According to the International Diabetes Federation (IDF) in 2021, approximately 537 million people worldwide, or 10.5% of adults, are estimated to have diabetes, 80% of whom are in low and middle-income countries. It is estimated that by 2030 the number will increase to 643 million people (11.3%), or one in 10 adults will have diabetes. The greatest increase will occur in developing countries. Indonesia is a country in Southeast Asia that is among the top 10 countries in the world with the highest number of diabetes sufferers. Indonesia is in fifth place with a total of 19.5 million. It is estimated that by 2045 the number of people with diabetes in Indonesia will increase by 28.6 million [11].

According to Ramadany, et al who conducted research in 2011 at RSUD DR. Moewardi Surakarta I obtained an Odds Ratio (OR) value of 3.8 and a confidence interval (95%) between 1.841-7.869 which shows that there is a significant relationship between diabetes mellitus and the incidence of ischemic stroke. An OR result that shows more than 1 means that diabetes mellitus is a risk factor for ischemic stroke and people diagnosed with diabetes mellitus have a 3.8 times higher risk of having ischemic stroke than people without diabetes mellitus [9]. This is supported by Latelay ANA research in 2019 with a cross-sectional method which showed a significant correlation between type 2 diabetes mellitus and the incidence of ischemic stroke ($p = 0.002$) and research by Antonious and Silliman in 2005 in the Northeast Florida Medicine Journal stated

that diabetes mellitus has proven to be a risk factor for stroke with an increased OR for the ischemic stroke of 1.6 to 8 times [12].

With estimates that the number of diabetes mellitus sufferers continues to increase in the world, it can be concluded that ischemic stroke sufferers also continue to increase. Based on the background above, the author is interested in conducting research with the title "The relationship between Diabetes Mellitus Type 2 and the incidence of acute ischemic stroke. The problem research is: Is there a relationship between type 2 diabetes mellitus and the incidence of acute ischemic stroke

MATERIALS & METHODS

Research Design

This study used an analytical observational research method with a cross-sectional design, namely using medical records of patients observed in a certain period. Then it was collected over the same period to find out the relationship between type 2 diabetes mellitus and the incidence of acute ischemic stroke at the Regional General Hospital, Dr. Chasbullah Abdulmadjid Bekasi City. The results of this research were processed using the Fisher exact test and then analyzed in depth.

Time and Place of Research

This research was conducted at the Regional General Hospital Dr. Chasbullah Abdulmadjid Bekasi City in February 2024.

Research Population and Sample

Research Population

All acute ischemic stroke patients at the Regional General Hospital Dr. Chasbullah Abdulmadjid Bekasi City in 2022 - 2023, totaling 127 people.

Research Sample

The sample for this study was acute ischemic stroke patients in 2022 - 2023, totaling 85 samples. Samples were taken using the Total Sampling technique, namely the entire population that had been determined by the

researcher based on inclusion and exclusion criteria

Sample Criteria

The sample criteria consist of inclusion criteria and exclusion criteria. Inclusion criteria are criteria that will be included in the sample, while exclusion criteria are criteria that will be excluded from the sample.

Inclusion Criteria

The inclusion criteria:

1. Patients diagnosed with acute ischemic stroke who are registered as inpatients at the Regional General Hospital Dr. Chasbullah Abdulmadjid.
2. Acute ischemic stroke patients who have complete medical records, including:
 - a) Patient biodata (age and gender)
 - b) Patient health status (fasting blood sugar levels, blood pressure, and blood lipid levels)

Exclusion Criteria

Patients diagnosed with ischemic stroke with incomplete medical record data (age, gender, fasting blood sugar levels, blood pressure, and blood cholesterol levels).

Data Processing and Analysis

Data processing

1. Editing
Editing is the stage where the information that has been collected is checked again. In the context of a change system, an analyst reviews data that has been collected through surveys.
2. Coding
Coding is a way of assigning certain codes to shorten the data to be analyzed.
3. Entry
After the coding stage, it is entered into a program on the computer, namely Microsoft Office Excel.
4. Tabulating
Grouping the data into tables for analysis, all data obtained was entered into the Microsoft Office Excel computer application program.

Data analysis

1. Univariate Analysis

Describe the characteristics of each research variable, namely age, gender, and risk factors such as hypertension and hypercholesterol which are displayed in a frequency distribution.

2. Bivariate Analysis

Statistical analysis aims to determine whether there is a relationship between the independent variable type 2 diabetes mellitus and the dependent variable acute ischemic stroke. Research analysis was carried out using the Chi-Square test and using the SPSS program.

RESULT

The research was conducted at the Regional General Hospital Dr. Chasbullah Abdulmadjid Bekasi City, the results of this

research were obtained from secondary data in the form of medical record data. Based on medical record data that met the inclusion criteria, 85 patients had a diagnosis of ischemic stroke and 2 patients had a diagnosis of non-ischemic stroke. The data that has been obtained will be analyzed univariately and bivariately.

Research result

Univariate Results

Research on the characteristics of ischemic stroke patients at the Regional General Hospital Dr. Chasbullah Abdulmadjid Bekasi City, Frequency of Ischemic Stroke Patients Based on gender showed that 36 patients with ischemic stroke were male (42.4%), and 49 patients (57.6%) were female. (Table 1)

Table 1: Frequency of Ischemic Stroke Patients Based on Gender.

| Gender | Frequency (n) | Percentage (%) |
|--------------|---------------|----------------|
| Male | 36 | 42,4 |
| Female | 49 | 57,6 |
| Total | 85 | 100 |

Frequency of Ischemic Stroke Patients Based on Age: It is known that there are 14 ischemic stroke patients aged ≤ 45 years

(16.5%), aged 46 – 65 years as many as 51 patients (60%), and age > 65 years as many as 20 patients (23.5%). (Table 2)

Table 2: Frequency of Ischemic Stroke Patients Based on Age

| Age | Frequency (n) | Percentage (%) |
|----------------|---------------|----------------|
| ≤ 45 year | 14 | 16,5 |
| 46 – 65 year | 51 | 60,0 |
| > 65 year | 20 | 23,5 |
| Total | 85 | 100 |

Frequency of Ischemic Stroke Patients Based on Hypertension Risk Factors: It was found that 57 patients with ischemic stroke had

hypertension (67.1%), and 28 patients without hypertension (32.9%). (Table 3)

Table 3: Frequency of Ischemic Stroke Patients Based on Hypertension Risk Factors.

| Hypertension | Frequency (n) | Percentage (%) |
|--------------|---------------|----------------|
| Yes | 57 | 67,1 |
| No | 28 | 32,9 |
| Total | 85 | 100 |

Frequency of Ischemic Stroke Patients Based on Hypercholesterol Risk Factors, the results showed that 23 patients with ischemic stroke

had hypercholesterolemia (27.1%), and 62 patients without hypercholesterolemia (72.9%). (Table 4)

Table 4: Frequency of Ischemic Stroke Patients Based on Hypercholesterol Risk Factors

| Hypercholesterol | Frequency (n) | Percentage (%) |
|------------------|---------------|----------------|
| Yes | 23 | 27,1 |
| No | 62 | 72,9 |
| Total | 85 | 100 |

Bivariate Test Results

Based on bivariate analysis tests to determine the relationship between Type 2 Diabetes Mellitus and Ischemic Stroke, the results showed that 47 patients with ischemic stroke

had GDP levels < 126 mg/dL and 38 patients had GDP levels ≥ 126 mg/dL. Meanwhile, 1 patient had a non-ischemic stroke with a GDP level < 126 mg/dL, and 1 patient with a GDP level ≥ 126 mg/dL. (Table 5)

Table 5: Relationship between Type 2 Diabetes Mellitus and Ischemic Stroke

| GDP levels Diabetes Mellitus Type 2 | Stroke | | | | Total | P value |
|---|-----------------|------|---------------------|-----|-----------|------------|
| | Ischemic Stroke | | Non-Ischemic Stroke | | | |
| | n | % | n | % | n | % |
| < 126 mg/dL | 47 | 97,9 | 1 | 2,1 | 48 | 100 |
| ≥ 126 mg/dL | 38 | 97,4 | 1 | 2,6 | 39 | 100 |
| Total | 85 | | 2 | | 87 | |

The results of research conducted using Chi-Square Analysis of the relationship between type 2 diabetes mellitus and ischemic stroke obtained a P value of 0.698. The results of the Pearson Chi Square analysis and Fisher exact test accepted H0 and rejected H1 (no relationship) with a p-value greater than 0.05, amounting to 0.698. A value of less than 0.05 is the maximum significant value in determining the relationship

DISCUSSION

Description of Ischemic Stroke Patients Based on Gender

From the data in Table 1, we can see the research results obtained from 85 medical records of ischemic stroke patients at the Regional General Hospital, Dr. Chasbullah Abdulmajid Bekasi City 2022-2023. 36 patients with ischemic stroke were male (42.4%), and 49 patients (57.6%) were female. These results are in line with research conducted by Sihotang at Adam Malik General Hospital in 2015. Of the 79 cases studied, it was found that ischemic strokes were more common in women, namely 51 cases (51%) and 28 cases (35.4%) occurred in men [19]. According to the National Center for Health Statistics, quoted from the article by Baso P (2014), the average incidence of stroke is higher in women than men. This may be related to special

conditions called Unique Risk Factors, namely several special ischemic stroke risk factors found in women, such as gestational diabetes, which is a condition caused by glucose intolerance that is first discovered during pregnancy, and the diabetes mellitus condition can persist after giving birth [7]. The risk of stroke in men and women depends on age. Women after menopause have a higher risk of stroke because the production of the hormone estrogen, which is beneficial for heart and blood vessel health, decreases after menopause. Therefore, women suffer more strokes at an advanced age [20].

The results of this study differ from research by Park et al in 2011 which showed that of the 59 patients studied, the majority of 32 people were men and 27 people were women [21]. The habits of alcohol consumption and smoking which are often carried out by men can contribute to the incidence of stroke [22]. Exposure to nicotine in individuals who smoke can cause the formation of plaque in blood vessels which in turn forms blood clots in the walls of arteries, reducing the amount of High-Density Lipoprotein (HDL), inhibiting the ability of HDL to excrete Low-Density Lipoprotein (LDL) cholesterol. excess, and increases fat oxidation which plays a role in the development of atherosclerosis [23].

Description of Ischemic Stroke Patients Based on Age

From the data in Table 2, we can see the research results obtained from 85 medical records of ischemic stroke patients at the Regional General Hospital, Dr. Chasbullah Abdulmadjid Bekasi City 2022-2023. There were 14 ischemic stroke patients aged ≤ 45 years (16.5%), 51 patients aged 46 – 65 years (60%), and age > 65 years were 20 patients (23.5%). The results obtained were that the majority of age characteristics were the elderly group, 51 patients (60%). These results are in line with research conducted by Fauzah et al in 2018 that stroke patients most often occur in the 46-50-year age group. The same results were also obtained by research by Badriyah et al in 2020 which stated that the age groups that had the largest distribution of strokes were 45-54 years (27.3%) and 55-64 (33.3%) [24]. These results are in line with the research conducted by Kelly in 2010 which stated that after the age of 45 years, the risk of having a stroke doubles every ten years [25]. This shows that compared to young people, older people are more susceptible to ischemic stroke.

As we age, first, vascular thickening occurs so that collagen and fibrous proteins accumulate in the walls of the arteries, which then causes the endothelial cells of the blood vessels to become stiff. In addition, there is a reduction in elastin protein so that the arteries lose their ability to dilate and contract efficiently, which causes an increase in pulse wave speed. The pressure waves created by each heartbeat travel faster through stiff arteries. As a result, systolic blood pressure increases, which can burden the blood vessels and increase the risk of hypertension which in turn increases the risk of stroke [26]. Second, the production of nitric oxide (NO), a molecule that dilates blood vessels and regulates blood flow, decreases, causing impaired vasodilation and there is an increase in the production of vasoconstrictor substances, such as endothelin-1 and thromboxane-A2. An imbalance of vasodilators and vasoconstrictors contributes

to endothelial dysfunction, inflammation, and atherosclerosis, all of which can increase the risk of stroke [27]. Third, age is a significant risk factor that encourages plaque formation in the arteries. Over time, plaque can become larger and narrow the lumen of arteries, resulting in blockage of blood vessels, and increasing the risk of ischemic stroke [28].

Description of Ischemic Stroke Patients Based on Hypertension Risk Factors

From the data in Table 3, we can see the research results obtained from 85 medical records of ischemic stroke patients at the Regional General Hospital, Dr. Chasbullah Abdulmadjid Bekasi City 2022-2023. There were 57 ischemic stroke patients with hypertension (67.1%), and 28 patients without hypertension (32.9%). These results are in line with research by Usrin et al that of 194 people suffering from hypertension, 137 people (70.6%) experienced ischemic stroke. The OR of hypertension on the incidence of ischemic stroke was found to be 10.95. This means that hypertension significantly influences the incidence of ischemic stroke and is a risk factor for ischemic stroke, namely the risk of ischemic stroke in people with hypertension is 11 times greater than in those without hypertension [29]. These results are also in line with research by Priyatna et al, namely that out of a total of 150 research subjects, 72.7% of stroke patients had hypertension [30]. Research by Tamburian et al noted that the proportion of cases who had hypertension was 80.6% and those who did not have hypertension was 19.4%. The results of this study showed that patients who had hypertension were 10.771 times more at risk of suffering from ischemic stroke compared to patients who had no history of hypertension. This follows the statement that hypertension is one of the main risk factors for stroke [32].

Hypertension is an increase in systolic blood pressure of more than 140 mmHg and diastolic blood pressure of more than 90 mmHg in two measurements with an interval of five minutes in a state of sufficient

rest/calm.30 Increased systemic blood pressure will cause cerebral blood vessels to constrict. The degree of constriction depends on the increase in blood pressure. If blood pressure increases for months or years, it will cause hyalinization of the muscle layer of the cerebral blood vessels which results in the diameter of the lumen of the blood vessels becoming fixed. This is dangerous because cerebral vessels cannot dilate or constrict freely to cope with fluctuating changes in systemic blood pressure. If there is a decrease in systemic blood pressure, the perfusion pressure to brain tissue is inadequate, resulting in cerebral ischemia [31].

Description of Ischemic Stroke Patients Based on Hypercholesterol Risk Factors

From the data in Table 4, we can see the research results obtained from 85 medical records of ischemic stroke patients at the Regional General Hospital, dr. Chasbullah Abdulmajid Bekasi City 2022-2023. There were 23 patients with ischemic stroke with hypercholesterolemia (27.1%), and 62 patients without hypercholesterolemia (72.9%).

These results are in line with research by Tamburian et al, namely that in the group of ischemic stroke cases who previously experienced hypercholesterolemia, there were 7 respondents (19.4%), and those who did not experience hypercholesterolemia, there were 29 respondents (80.6%) [32]. Koosgiarto in 2015 conducted a similar study, stating that there was no significant relationship between hypercholesterolemia and ischemic or hemorrhagic stroke. Fewer respondents suffered from stroke with high LDL cholesterol levels compared to respondents who had low LDL cholesterol levels ($p=0.271$; $OR=1.3$). This is also in line with research conducted by Farhan et al, namely ischemic stroke patients with low LDL cholesterol levels. Normal cholesterol was 8 samples (50%), borderline high cholesterol levels were 6 samples (37%), and high cholesterol levels were 2 samples (13%). These results are not in line with research by Jamini et al in 2020 which

showed there was a relationship between blood cholesterol levels and the incidence of stroke with a p-value of 0.004 ($p<0.05$) [33]. Hypercholesterolemia is an increase in total cholesterol levels exceeding 200 mg/dL in the blood, which is a risk factor for ischemic stroke as a result of atherosclerosis, namely the buildup of plaque on the walls of arteries which inhibits blood flow so that the diameter of blood vessels decreases and causes decreased perfusion to tissues, including the brain [34]. However, In this study, the results were found different. This can occur due to increased blood cholesterol levels in patients diagnosed with ischemic stroke as only one risk factor, there are still other risk factors such as hypertension, heart disease, smoking habits, and obesity [32].

Relationship between Type 2 Diabetes Mellitus and Ischemic Stroke

From the data in Table 5, we can see the research results obtained from 87 medical records of ischemic stroke and non-ischemic stroke patients at the Regional General Hospital, dr. Chasbullah Abdulmajid Bekasi City 2022-2023. There were 47 ischemic stroke patients with GDP levels < 126 mg/dL and 38 patients with GDP levels ≥ 126 mg/dL. Meanwhile, 1 patient had a non-ischemic stroke with a GDP level < 126 mg/dL, and 1 patient with a GDP level ≥ 126 mg/dL. The results of research conducted using Chi-Square Analysis of the relationship between type 2 diabetes mellitus and ischemic stroke obtained a P value of 0.698. The results of the Pearson Chi-Square analysis and Fisher exact test accepted H_0 and rejected H_1 (no relationship) with a p-value greater than 0.05, amounting to 0.698. A value of less than 0.05 is the maximum significant value in determining the relationship.

These results followed research by Jayendra and Arinda in 2013 using a cross-sectional method, namely that no correlation was found between diabetes mellitus and the incidence of ischemic stroke ($p = 0.076$) and diabetes mellitus is not a major risk factor for ischemic stroke (95% confidence interval

(CI) = 0.944-3.308). Apart from that, research from Faruqi, 2021 using a case-control method analyzed various factors that can cause ischemic stroke, diabetes mellitus did not affect ischemic stroke ($p = 1,000$) [35]. Research conducted by Ainanda IP was also found based on medical record data, from 217 of ischemic stroke patients treated at H. Adam Malik General Hospital, Medan in 2010, only 65 patients (30%) had a history of type 2 diabetes mellitus, the remaining 152 patients (70%) did not have a history of type 2 diabetes mellitus [36]. Research by Izzati in 2019 showed that 82 patients (78.85%) had ischemic stroke with normal blood sugar levels, 17 patients (16.35%) had high blood sugar levels, and 5 patients (4.80%) did not have information on blood sugar levels [37]. This is in line with research by Tamburian et al which reported 83.3% of ischemic stroke patients without diabetes mellitus [32].

These results are not in line with research by Letelay in 2019 which found a relationship between type 2 diabetes mellitus and the incidence of stroke. Analysis using the Chi-Square test obtained a value of $P=0.002$. Thus, statistically, there is a significant relationship between type 2 diabetes mellitus and the incidence of stroke [12]. This result is also not in line with research by Ramadhany et al in 2013 with a cross-sectional method which found a significant correlation between diabetes mellitus and ischemic stroke ($p<0.000$) and people with diabetes mellitus have a 3.8 greater risk of ischemic stroke (OR = 3.8 and CI = 1.841-7.869) [9].

According to research in the Diabetes Care Journal, diabetes mellitus is a risk factor that can be modified but is not the sole factor for stroke. Several other factors influence the occurrence of stroke [9]. The presence of other cardiovascular risk factors, especially hypertension, is the main risk factor for atherosclerosis and is closely related to the incidence of ischemic stroke and often occurs together with other risk factors, including dyslipidemia and diabetes mellitus. The risk of ischemic stroke in people with diabetes mellitus depends on the type, severity, and

duration of suffering [36]. In samples with normal sugar levels, ischemic stroke can occur due to other risk factors such as hypertension, dyslipidemia, and others [38]. Based on research results, theory, and related research. Researchers assume that there is no relationship between type 2 diabetes mellitus and ischemic stroke because ischemic strokes can be caused by many factors. This research is not the same as the course of ischemic stroke with type 2 diabetes mellitus. Excessive blood sugar in the body can cause an increase in free radicals or ROS (Reactive Oxygen Species), which can cause DNA strand damage in cells and then endothelial dysfunction. Apart from that, there are metabolic abnormalities in diabetes mellitus, namely increased levels of PAI-1 (plasminogen activator inhibitor-1), so that abnormal clots can form, resulting in increased intravascular coagulation processes. This process will result in the formation of a thrombus. If the thrombus is loose it can cause an embolus and enter the blood vessels of the brain, thereby blocking blood flow to the brain. As a result, the brain lacks a supply of oxygen and glucose so cells in the brain cannot produce energy (ATP). If the brain lacks energy, cell death (apoptosis) occurs which causes death in the brain [35].

CONCLUSION

Based on the results of the research carried out, the following conclusions were obtained:

1. The frequency based on the gender of ischemic stroke patients in this study was mostly women with a total of 49 people (57.6%), while men were 36 people (42.4%).
2. The highest age range for ischemic stroke patients in this study was 46-65 years with a total of 51/85 subjects (60%).
3. The frequency of ischemic stroke patients with hypertension dominated this study, namely 57/85 subjects (67.1%).
4. The frequency of ischemic stroke patients without hypercholesterolemia

dominated this study, namely 62/85 subjects (72.9%).

5. There is no significant relationship between type 2 diabetes mellitus and the incidence of acute ischemic stroke at the Dr. Regional General Hospital. Chasbullah Abdulmadjid Bekasi City 2022 – 2023 (p=0.698).

Declaration by Authors

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