



RESEARCH ARTICLE

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COMPARISON OF LIPID PROFILE LEVELS IN PATIENTS WITH ISCHEMIC STROKE AND HEMORRHAGIC STROKE AT RADEN MATTABER HOSPITAL JAMBI

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ABSTRACT

Background: Stroke attacks the brain, causing neurological disorders and even death. In 2023, there were 337 stroke cases at RSUD Raden Mattaber Jambi.

Objective: This study aims to analyze differences in lipid profile levels between patients with ischemic and hemorrhagic strokes at Raden Mattaber Hospital in 2023.

Methods: This study used a cross-sectional comparative analytical design with a quantitative approach, and the sample consisted of 101 ischemic and 101 hemorrhagic stroke patients, each selected through purposive sampling.

Results: Findings showed that the majority of ischemic and hemorrhagic stroke patients were aged 56-65 years. Ischemic stroke patients were predominantly female, while men were predominantly affected by hemorrhagic stroke. Most stroke patients had normal pulse rate and body temperature, with blood pressure most frequently in stage 2 hypertension. Respiratory rates were normal in ischemic stroke patients but showed tachypnea in hemorrhagic stroke. Triglyceride and LDL levels were higher on average in ischemic stroke patients, while total cholesterol and HDL levels were higher in hemorrhagic stroke patients.

Conclusion: Significant differences were observed in lipid profile components, specifically triglycerides, HDL, and LDL, between patients with ischemic and hemorrhagic strokes. However, there was no significant difference in total cholesterol levels.

Keywords: hemorrhagic stroke, ischemic stroke, lipid profile



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Introduction

Stroke is a disease that affects the brain, clinically presenting as local or global neurological disorders and potentially causing death. This disease is progressive and appears suddenly and quickly.^{1,2} Stroke causes a rapid decrease in cerebral blood flow, impairing brain function.³ According to the World Stroke Organization (WSO), there are more than 12.2 million new cases every year. Overall, one in four people will experience a stroke at age ≥ 25 years.⁴ The World Health Organization (WHO) reports that each

year, there are approximately 13.7 million new cases of stroke, and deaths caused by this disease total around 5.5 million. In 2018, nationally, about 10.9% of the Indonesian population aged over 15 years, or 2,120,362 people, experienced a stroke. In 2019, the number of stroke incidents in Indonesia reached 293.3 per 100,000 people.^{5,6}

Every year, more than 7.6 million new cases of ischemic stroke occur worldwide, and hemorrhagic stroke accounts for over 3.4 million new cases. In Indonesia, ischemic stroke is the most prevalent type, followed by hemorrhagic stroke. Strokes are more

common in women and in individuals aged ≥ 70 years.^{5,7} Although previous studies have examined lipid profiles in stroke patients, findings on differences between ischemic and hemorrhagic stroke remain inconsistent across populations. Additionally, data from regional hospitals in Indonesia, particularly in Jambi, are limited.

Dyslipidemia, a condition characterized by abnormal lipid levels in the blood, is one factor that can lead to a stroke. It is marked by elevated levels of total cholesterol, triglycerides, and Low-Density Lipoprotein (LDL), or a decrease in High-Density Lipoprotein (HDL). These abnormal lipid levels can result from the accumulation of fat in the blood vessels, a condition commonly referred to as atherosclerosis^{8,9}. Therefore, this study aims to compare lipid profiles between ischemic and hemorrhagic stroke patients at Raden Mattaher Hospital, Jambi, to provide local epidemiological evidence.

Atherosclerosis in the blood vessels of the brain can block internal and external arteries or cortical arteries, initiated by LDL cholesterol in the intima of the arteries.^{10,11} Meanwhile, other studies show a positive relationship between LDL cholesterol and ischemic stroke and an inverse relationship with hemorrhagic stroke.¹²

Methods

Study Design and Subject

This study used a cross-sectional comparative analytical design. The study was conducted at Raden Mattaher Hospital in Jambi, Indonesia, in 2023. The sample consisted of 101 ischemic stroke patients and 101 hemorrhagic stroke patients selected through purposive sampling. Inclusion and exclusion criteria were applied to identify eligible subjects. Data were collected from medical records and analyzed using appropriate statistical tests, including the unpaired t-test and the Mann–Whitney test, based on data distribution.

Research Sample

Samples were collected using purposive sampling. The minimum sample size was calculated using a formula for comparing two independent numerical groups. The inclusion criteria for this study consisted of patients who were hospitalized at Raden Mattaher Hospital in Jambi in 2023, diagnosed with either ischemic or hemorrhagic stroke, and who had undergone lipid profile testing. This testing provided data on total cholesterol, triglycerides, HDL, and LDL levels. Patients with missing or unreadable medical records were excluded from the study.

Statistical Analysis

The statistical analysis used in this research includes univariate and bivariate tests, with the Kolmogorov-

Smirnov test to assess whether the data are normally distributed. For normally distributed data, the independent-samples t-test was applied, whereas the Mann–Whitney U test was used for non-normally distributed data.

Results

A total of 101 patients with ischemic stroke and 101 patients with hemorrhagic stroke were identified from medical records at Raden Mattaher Hospital Jambi in 2023. The analysis of these samples is as follows:

Table 1. Demographics of Stroke Patients

Demographics	N	Percentage (%)
Sex		
Male	102	50.5
Female	100	49.5
Age (years)		
Early Adulthood (26-35)	3	1.5
Late Adulthood (36-45)	14	6.9
Early Elderly (46-55)	60	29.7
Late Elderly (56-65)	72	35.6
Elderly (>65)	53	26.3
Types of stroke		
Ischemic Stroke	101	50
Hemorrhagic Stroke	101	50

Table 1 shows that stroke patients at Raden Mattaher Regional Hospital are predominantly male (50.5%). By age, the majority were late elderly (35.6%), followed by early elderly (29.7%), elderly (26.3%), late adults (6.9%), and early adults (1.5%).

Table 2. Characteristics of Ischemic Stroke Patients

Characteristics	N	Percentage (%)
Sex		
Male	50	49.5
Female	51	50.5
Age (Years)		
Early Adulthood (26-35)	1	1
Late Adulthood (36-45)	8	7.9
Early Elderly (46-55)	24	23.8
Late Elderly (56-65)	35	34.7
Elderly (>65)	33	32.7
Systolic Blood Pressure (mmHg)		
Normal (<120)	14	13.9
Prehypertension (120-139)	11	10.9
Stage 1 Hypertension (140-159)	35	34.7
Stage 2 Hypertension (≥ 160)	41	40.6
Diastolic Blood Pressure (mmHg)		
Normal (<80)	29	28.7
Prehypertension (80-89)	14	13.9
Stage 1 hypertension (90-99)	21	20.8
Stage 2 hypertension (≥ 100)	37	36.6

According to Table 2, the distribution of ischemic stroke cases by gender at Raden Mattaher Hospital Jambi in 2023 is dominated by women (50.5%). By age group, the most cases of ischemic stroke were found in the late elderly, aged 56-65 years (34.7%). The highest systolic blood pressure among stroke

patients was stage 2 hypertension (≥ 160 mmHg) at 40.6%, while the highest diastolic blood pressure was also stage 2 hypertension (≥ 100 mmHg) at 36.6%.

Table 3. Characteristics of Hemorrhagic Stroke Patients

Characteristics	N	Percentage (%)
Sex		
Male	52	51.5
Female	49	48.5
Age (Years)		
Early Adulthood (26-35)	2	2
Late Adulthood (36-45)	6	5.9
Early Elderly (46-55)	36	35.6
Late Elderly (56-65)	37	36.6
Elderly (>65)	20	19.8
Systolic Blood Pressure (mmHg)		
Normal (<120)	4	4
Prehypertension (120-139)	8	7.9
Stage 1 Hypertension (140-159)	15	14.9
Stage 2 Hypertension (≥ 160)	74	73.3
Diastolic Blood Pressure (mmHg)		
Normal (<80)	16	15.8
Prehypertension (80-89)	12	11.9
Stage 1 hypertension (90-99)	17	16.8
Stage 2 hypertension (≥ 100)	56	55.4

According to Table 3, men account for 51.5% of hemorrhagic stroke cases at Raden Mattaher Regional Hospital. By age group, most cases were in the elderly aged 56-65 years (36.6%). Among hemorrhagic stroke patients, systolic blood pressure was stage 2 hypertension (≥ 160 mmHg) in 73.3%, and diastolic blood pressure was also stage 2 hypertension (≥ 100 mmHg) in 55.4%.

Table 4. Comparison of Lipid Profile Levels between Ischemic and Hemorrhagic Stroke Patients

Lipid Profile	Ischemic Stroke	Hemorrhagic Stroke	p-value
Total Cholesterol	206.51	207.52	.885
Triglycerides	120	105	.047
HDL	48	60	.001
LDL	136.07	120.82	.020

* $p < 0.05$ was considered statistically significant

*Statistical analysis was performed using independent t-test or Mann-Whitney U test based on data distribution

The lipid profile characteristics of patients with ischemic and hemorrhagic stroke are presented in Table 4. Triglyceride and LDL levels were higher in patients with ischemic stroke, whereas HDL levels were higher in those with hemorrhagic stroke. Statistical analysis showed significant differences in triglyceride, HDL, and LDL levels ($p < 0.05$), whereas total cholesterol was not significantly different ($p > 0.05$).

Discussion

Significant differences were observed in triglyceride, HDL, and LDL levels between patients with ischemic and hemorrhagic stroke, whereas total cholesterol levels did not differ significantly. The

average total cholesterol level in patients with ischemic stroke was 206.51 mg/dl, compared with 207.52 mg/dl in those with hemorrhagic stroke. The analysis using the independent t-test revealed a p-value greater than 0.05, indicating no significant difference in total cholesterol levels between patients with ischemic and hemorrhagic strokes. These results align with research conducted in Saudi Arabia, which also reported no significant difference in total cholesterol levels between the two groups, with a p-value exceeding 0.05.²⁶

Ischemic stroke patients have a median triglyceride level of 120 mg/dl, compared with 105 mg/dl in hemorrhagic stroke patients. The bivariate test yielded a p-value of <0.05 , indicating a significant difference in triglyceride levels between the two groups. This finding aligns with research, which also reported significant differences in triglyceride levels, confirmed by a p-value <0.05 . Elevated triglyceride levels in the bloodstream, often derived from dietary fats, can adversely affect arterial health. Triglycerides undergo lipolysis within the blood vessels, and the resulting particles are small enough to cross the endothelial layer. These particles are subsequently captured by macrophages in the artery walls, contributing to the development of atherosclerosis.^{13,27}

The study found that the median HDL level among ischemic stroke patients was 48 mg/dl. In contrast, hemorrhagic stroke patients had a higher median HDL level of 60 mg/dl. The significant difference in HDL levels between the two groups was confirmed by a p-value <0.05 . This finding aligned with research, which also reported a significant disparity in HDL levels between ischemic and hemorrhagic stroke patients, with a p-value of less than 0.001.²⁸

In the study, LDL cholesterol levels were analyzed in patients with ischemic and hemorrhagic strokes. The results indicated that ischemic stroke patients had an average LDL cholesterol level of 136.07 mg/dL, whereas hemorrhagic stroke patients had an average LDL cholesterol level of 120.82 mg/dL. The comparative analysis revealed a significant difference in LDL cholesterol levels between the two groups ($p < 0.05$). This finding is consistent with previous research, which also reported significant differences in LDL cholesterol levels between ischemic and hemorrhagic stroke patients.¹³

The distribution of stroke cases by gender showed that men had a higher prevalence, with 50 cases (49.5%) of ischemic stroke and 52 cases (51.5%) of hemorrhagic stroke. In comparison, women had 51 cases (50.5%) of ischemic stroke and 49 cases (48.5%) of hemorrhagic stroke. This aligns with Hairani's research (2022), which indicated that male patients were also predominant in both types of stroke, with 31 cases (58.5%) of male ischemic stroke sufferers and 28

cases (54.9%) of hemorrhagic stroke. Conversely, female stroke sufferers comprised 22 cases of ischemic stroke (45.1%) and 23 cases of hemorrhagic stroke (45.1%).¹³ The higher risk for stroke in men is often linked to elevated rates of hypertension and lifestyle factors, such as smoking and alcohol consumption.¹⁴

The prevalence of ischemic stroke is notably higher among the late elderly (ages 56–65), accounting for 35 cases (34.7%), while early adults (ages 26–35) have the lowest prevalence, with only 1 case (1%). For hemorrhagic stroke, similar trends are observed, with the late elderly having 37 cases (36.6%), whereas the early adulthood demographic has 2 cases (2%). This observation is consistent with previous findings, which reported that the majority of stroke patients fell within the age range of 55–64 years, comprising 30 individuals (55.5%).²⁴ The high incidence of stroke in the elderly can be attributed to age, a non-modifiable risk factor. Brain weight typically decreases by approximately 0.1% per year from ages 20 to 60 and continues to increase.¹

Systolic blood pressure measurements in ischemic stroke patients were predominantly classified as stage 2 hypertension (≥ 160 mmHg), with 41 cases (40.6%). In contrast, the least common classification was prehypertension (120–139 mmHg), observed in 11 cases (10.9%). For patients with hemorrhagic stroke, stage 2 hypertension was also the most common category, accounting for 74 cases (73.3%), while only 4 patients (4%) exhibited normal systolic blood pressure. These findings are consistent with previous research, which similarly indicated that the average systolic blood pressure among stroke patients fell within the category of stage 2 hypertension.¹⁷

In addition to systolic blood pressure, diastolic blood pressure characteristics were also examined. Most ischemic stroke patients fell into the stage 2 hypertension category (≥ 100 mmHg), with 37 cases (36.6%), while the fewest had prehypertension (80–89 mmHg), with 14 cases (13.9%). In the hemorrhagic stroke group, diastolic blood pressure was similarly dominated by stage 2 hypertension, with 56 cases (55.4%), and only 12 cases (11.9%) were classified as prehypertension. These findings are consistent with previous studies reporting that diastolic blood pressure in stroke patients was in the prehypertension category (87 mmHg). These findings suggest that elevated diastolic blood pressure is common among patients with stroke.¹⁶

Ischemic stroke patients often experience high blood pressure as a response to the narrowing of blood vessels, a way for the body to maintain sufficient blood supply to the brain despite reduced flow. This compensatory mechanism becomes crucial because the brain still requires oxygen and nutrients. On the other hand, individuals suffering from hemorrhagic stroke

may also experience hypertension, but this is typically due to the blood vessels reaching their maximum capacity in trying to supply blood. In this case, the increased pressure can lead to vessel rupture, resulting in bleeding within or around the brain.^{18,19} This study has several limitations, including its retrospective design, reliance on secondary data from medical records, and limited control over confounding variables such as comorbidities and medication use.

Conclusion

There are significant differences in triglyceride, HDL, and LDL levels between patients with ischemic and hemorrhagic strokes, whereas total cholesterol levels do not differ significantly.

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