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Epidemiologic Profile of Ischemic Stroke Patients with Dyslipidemia in Dr. Soetomo General Academic Hospital Patient

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Article info	ABSTRACT
	Introduction: Ischemic stroke is a major medical issue, especially in individuals with dyslipidemia, as it can elevate both the likelihood and severity of stroke incidents. This study is essential due to the rising prevalence of stroke and limited data regarding ischemic stroke patients with dyslipidemia in Indonesia. Understanding these traits is important for enhancing preventative and treatment strategies. **Objective:** This study intended to assess the epidemiologic profile of ischemic stroke patients with dyslipidemia in a tertiary hospital in Indonesia. **Methods:** This descriptive study assessed 116 medical records of ischemic stroke patients with dyslipidemia admitted to Dr. Soetomo General Academic Hospital in Surabaya, Indonesia, from January to June 2023. The collected data encompassed demographics, comorbidities, lipid profiles, and clinical outcomes. Dyslipidemia was defined based on the PERKENI guidelines, and stroke severity was assessed using the GCS and NIHSS scales. **Results:** The majority of ischemic stroke patients with dyslipidemia (77.6%) had low HDL-C levels. There were 64 males and 52 females; most of them were between the ages of 56 and 65. Hypertension was the most common comorbidity (64.7%), followed by diabetes (39.7%), heart disease (12.9%), and obesity (11.2%). Of 40 NIHSS-assessed patients, 26 had moderate, 8 mild, 2 moderate-to-severe, and 4 severe strokes. The majority of patients (70.7%) recovered. **Conclusion:** The majority of dyslipidemia-related ischemic stroke patients, aged 56 to 65, had low HDL-C levels. Hypertension was the main comorbidity, with many experiencing their first stroke. Most patients had high consciousness, moderate stroke severity, and showed improvements.

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INTRODUCTION

Stroke is the world's second leading cause of mortality and disability. The general stroke rate has increased to 94 per 100,000 people in the last ten years. However, the rate is substantially higher, reaching up to 1,216 per 100,000 adults over the age of 75. Stroke mortality occurs in low-income countries at a high rate, accounting for around 85%.[1] The incidence of stroke cases in Indonesia has grown to be a serious local health issue. According to the Minister of Health of the Republic of Indonesia, the prevalence of stroke among the 713,783 Indonesians aged ≥ 15 years who participated in the survey was 10.9‰ (10.9 cases per 1,000 people) in 2018. Compared to 2013, when the prevalence of stroke was 7.0‰ (7 cases per 1,000 people), this figure indicates an increase.[2]

The pathology of a stroke determines whether it is ischemic or hemorrhagic. A thrombotic or embolic event disrupts blood flow to a specific area of the brain, resulting in an ischemic stroke.[3] Ischemic stroke accounts for roughly more than half of all strokes globally. In 2020, there were around 7.59 million ischemic strokes and 3.48 million ischemic stroke-related deaths.[4]

One of the main risk factors for ischemic stroke is dyslipidemia. In ischemic stroke, people are predisposed to atherosclerosis by both elevated levels of total cholesterol and low-density lipoprotein.[5] Other comorbidities and risk factors for ischemic stroke include hypertension, diabetes, cardiovascular disease, and smoking. Reducing the associated risk factors and comorbidities can lower the risk of stroke and be an essential part of treatment.[6] GCS and NIHSS are essential tools for determining stroke severity, providing physicians with critical prognostic information. Physicians can use this information to predict clinical outcomes and build more effective management strategies for patients.

Despite the well-known association between ischemic stroke and dyslipidemia, there is limited data regarding the demographics, comorbidities, lipid profiles, severity, and outcomes of ischemic stroke patients with dyslipidemia, particularly in Indonesia. This study intended to fill these gaps by providing evidence-based data that can be used to make public health regulations, enhance clinical procedures for managing dyslipidemia in ischemic stroke patients, and encourage early prevention strategies to mitigate risk factors. It is expected that these findings would contribute to reducing Indonesia's stroke burden.

OBJECTIVE

This study looked at the demographics, comorbidities, lipid profiles, and stroke severity as measured by GCS and NIHSS. It also looked at the clinical outcomes of ischemic stroke patients with dyslipidemia receiving treatment at a tertiary referral hospital in Indonesia, which is Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from January to June 2023.

METHODS

This study was carried out from January to June 2023 at the Neurology Ward, Seruni A, Dr. Soetomo General Academic Hospital in Surabaya, Indonesia, with ethical approval granted by the hospital's Health Research Ethics Committee. The study's approval number is 2346/121/4/VIII/2023. The study used a descriptive observational design and a total sample of all inpatient ischemic stroke patients diagnosed with dyslipidemia who met the inclusion criteria. Inpatient medical records from the Neurology Ward, Seruni A, along with a comprehensive medical record of patients diagnosed with both ischemic stroke and dyslipidemia, were used as criteria for inclusion. We used imaging techniques, like head multi-slice computed tomography (MSCT) and magnetic resonance imaging (MRI), to confirm that the patient had an ischemic stroke based on information from their medical records. Meanwhile, exclusion criteria encompassed those with non-ischemic strokes, ischemic strokes without dyslipidemia, and those with incomplete medical records.

Lipid profiles were obtained at the time of hospital admission for ischemic stroke. According to Perkumpulan Endokrinologi Indonesia (PERKENI), someone has dyslipidemia if their total cholesterol (TC) is 240 mg/dl or higher, their low-density lipoprotein cholesterol (LDL-C) is 160 mg/dl or higher, their high-density lipoprotein cholesterol (HDL-C) is less than 40 mg/dl, or their triglyceride (TG) is 200 mg/dl or higher, as measured at the time of hospital admission due to ischemic stroke. Data were collected from patient medical records, including demographic information, medical history, and lipid profiles. The severity of stroke was assessed at initial admission using the Glasgow Coma Scale (GCS) and the National Institutes of Health Stroke Scale (NIHSS). Outcomes were assessed according to the discharge status recorded in medical records. The discharge status was classified into four groups: clinical improvement, discharged from care, discharged against medical advice, and passed away.

Clinical improvement was defined as patients being discharged in stable condition with no significant complications during hospitalization. There were no additional clinical outcome tools or follow-up data available for the study after discharge. Descriptive statistics were obtained using IBM SPSS

Statistics 25, which used frequency distribution tables to describe factors such as patient demographics, comorbidities, severity, and clinical outcomes.

RESULTS

From January to June 2023, 198 individuals were diagnosed with ischemic stroke and hospitalized in the Neurology Ward, Seruni A, Dr. Soetomo General Academic Hospital. Of these, 116 patients met the necessary inclusion criteria. Upon admission to the inpatient unit, only 40 of the 116 patients with ischemic stroke and dyslipidemia underwent an NIHSS score examination.

Sex and age

Table 1 presents a total of 64 male patients (55.2%) and 52 female patients (44.8%). The age group of 26–35 years had the lowest number of patients, with only one (0.9%), while the age group of 56–65 years had the highest number, consisting of 51 patients (44%). The age groups of 36–45 years, 46–55 years, and over 65 years showed different frequency distribution results, with 8, 29, and 27 patients, respectively.

Table 1. Frequency distribution of patients sex and age

Variable	n	Percentage (%)
Sex		
Male	64	55.2
Female	52	44.8
Age		
26-35	1	0.9
36-45	8	6.9
46-55	29	25
56-65	51	44
> 65	27	23.3

Occupation

Table 2 shows that 37 patients (31.9%) were unemployed. In contrast, the majority of patients (37.9%) worked in the private sector, followed by 24 patients (20.7%) who were self-employed. Only 3 patients (2.6%) engaged in farming or agricultural labor, while 8 patients (6.9%) pursued employment in other fields.

Table 2. Frequency distribution of patients' occupation

Variable	n	Percentage (%)
Unemployed	37	31.9
Private employee	44	37.9
Entrepreneur	24	20.7
Farmer / agricultural laborer	3	2.6
Others	8	6.9

Frequency of stroke attacks and comorbidities

According to Table 3, 76 patients (65.5%) had their first stroke, 26 patients (22.4%) had their second, 11 patients (9.5%) had their third, and the fewest number of patients (0.9%) had their fourth. Moreover, 2 patients (1.7%) experienced more than four strokes.

A history of hypertension was the most common, affecting 75 patients (64.7%), while a history of dyslipidemia was the least common, impacting only 4 patients (3.4%). A total of 46 patients (39.7%) had a history of diabetes mellitus, whereas 15 patients (12.9%) had heart disease, and 13 patients (11.2%) were obese.

Table 3. Frequency distribution of patients' frequency of stroke attack and comorbidity

Variable	n	Percentage (%)
Frequency of Stroke Attack		
First	76	65.5
Second	26	22.4
Third	11	9.5
Fourth	1	0.9
More than five	2	1.7
Comorbidity		
Dyslipidemia	4	3.4
Hypertension	75	64.7
Diabetes Melitus	46	39.7
Heart Disease	15	12.9
Obesity	13	11.2

Lipid Profiles

Table 4 shows the majority of patients (54.3%) had normal total cholesterol levels (< 200 mg/dl). In contrast, the smalles group in this category, consisting 26 patients (22.4%), had borderline levels (200–239 mg/dl). A total of 27 patients (23.3%) had high total cholesterol levels (≥ 240 mg/dl). For LDL-C levels, the majority of patients (23.3%) had normal levels (<100 mg/dl). There were 21 patients (18.1%) with close to normal levels (100–129 mg/dl), 26 patients (22.4%) with borderline levels (130–159 mg/dl), 24 patients (20.7%) with high levels (160–189 mg/dl), and 18 patients (15.5%) in the very high levels (≥ 190 mg/dl), which was the smallest group.

Low HDL-C levels (< 40 mg/dl) were present in the majority of patients (77.6%). The HDL-C levels of 25 patients (21.6%) were normal (40–59 mg/dl), while only 1 patient (0.9%) had high HDL-C levels (≥ 60 mg/dl). In the case of triglycerides, 74 patients (63.8%) had values that were within the normal range (< 150 mg/dl). There were 14 patients (12.1%) with borderline levels (150–199 mg/dl) and 27 patients (23.3%) with high levels (200–499 mg/dl). Only one patient (0.9%) had extremely elevated triglyceride levels (> 500 mg/dl).

Table 4. Frequency distribution of patient's lipid profiles

Variable	n	Percentage (%)
Total Cholesterol		
Normal (< 200 mg/dl)	63	54.3
Borderline (200–239 mg/dl)	26	22.4
High (≥ 240 mg/dl)	27	23.3
LDL-C		
Normal (<100 mg/dl)	27	23.3
Close to normal (100–129 mg/dl)	21	18.1
Borderline (130–159 mg/dl)	26	22.4
High (160–189 mg/dl)	24	20.7
Very high (≥ 190 mg/dl)	18	15.5
HDL-C		
Low (<40 mg/dl)	90	77.6
Normal (40–59 mg/dl)	25	21.6
High (≥60 mg/dl)	1	0.9
Triglyceride		
Normal (< 150mg/dl)	74	63.8
Borderline (150–199 mg/dl)	14	12.1
High (200–499 mg/dl)	27	23.3
Very high (≥ 500 mg/dl)	1	0.9

Stroke severity

According to Table 5, the lowest percentage of patienta (18.1%) had low consciousness (GCS 3-8). On the other hand, 60.3% exhibited high levels of consciousness (GCS 13–15), whereas 21.6% of patients exhibited moderate levels of consciousness (GCS 9–12).

Only 40 patients had heir NIHSS scores upon hospitalization. Among them, 8 patients (20%) had mild stroke severity, while 26 patients (65%) had moderate stroke severity. Only two patients (5%) experienced moderate-to-severe strokes, while four patients (10%) suffered severe strokes.

Table 5. Patient level of conciousness and severity

Variable	n	Percentage (%)
Level of consciousness		
Low (GCS 3-8)	21	18.1
Moderate (GCS 9-12)	25	21.6
High (GCS 13-15)	70	60.3
NIHSS scoring		
Mild stroke (0-4)	8	23.3
Moderate stroke (5-15)	26	18.1
Moderate–severe stroke (16-20)	2	22.4
Severe stroke (21-42)	4	20.7

Patient outcome

Table 6 shows that 82 patients (70.7%) showed improvement, 3 patients (2.6%) left against medical advice, and 8 patients (6.9%) received discharged from care. However, a total of 23 patients (19.8%) passed away.

Table 6. Patient outcome

Variable	n	Percentage (%)
Clinical improvement	82	70.7
Discharged from care	8	6.9
Discharged against medical advice	3	2.6
Passed away	23	19.8

DISCUSSION

Sex and Age

According to our research, the majority of ischemic stroke patients with dyslipidemia were males aged 56–65. These findings are consistent with Ramadhani et al., who found that most patients were males aged 56–70.[7] Compared to men, women in their reproductive years are more resistant to cardiovascular disease (CVD). One mechanism that explains this phenomenon is the existence of estrogen in women. In addition to its preventive qualities, estrogen has several positive effects on blood vessels, such as enhancing endothelial function, lowering CVD risk factors, and preventing the progression of atherosclerosis.[8]

Occupation

This study found that most ischemic stroke patients with dyslipidemia were employed. These findings align with Handayani et al., who discovered that a majority of patients with ischemic stroke were employed (52.63%).[9] A metabolic disease, such as stroke, is related to a sedentary lifestyle, which is common among workers.[10] On the other hand, an increased risk of ischemic stroke was associated with psychosocial stress, which encompasses occupational factors.[11]

Frequency of stroke attack

A first-time ischemic stroke was experienced by the majority of ischemic stroke patients with dyslipidemia. Prabawati and Pitaloka's study, which is consistent with the findings, revealed that over half of stroke patients (52.1%) experienced non-recurrent strokes, which is consistent with the findings.[12] Previous ischemic stroke has been independently linked to an increased risk of recurrence. In addition, the overall mortality risk increased by twofold from recurrent ischemic stroke, which was an important independent factor.[13]

Comorbidities

Hypertension was the most common comorbidity

in this study. This study aligns with the findings of Ramadhani *et al.*, who found hypertension in more than two-thirds of ischemic stroke patients (72.2%).[7] Hypertension is a significant comorbidity in the progression of atherosclerotic disease, potentially leading to ischemic stroke. Other comorbidities such as diabetes, heart disease, dyslipidemia, and obesity also increase the risk of ischemic stroke by contributing to the incidence of thromboembolism.[6]

Dyslipidemia

This study revealed that dyslipidemia was common among ischemic stroke patients. The study detcted lower HDL cholesterol as the predominant dyslipidemia abnormality. It also aligns with the findings of Adam *et al.*, which revealed that 71.8% of ischemic stroke patients exhibited insufficient HDL-C levels.[14] Cholesterol levels are directly linked to ischemic strokes, which are the result of a complex relationship between cerebrovascular disease and lipids. High levels of total cholesterol and LDL contribute to the development of atherosclerosis.[15] Furthermore, an increased incidence of stroke and worsened long-term outcomes are associated with low HDL levels. There are numerous mechanisms by which HDL protects against atherosclerosis, which may account for these findings.[16]

Stroke severity

The study's results showed that most patients with ischemic stroke and dyslipidemia were fully conscious (GCS 13–15), but most of their NIHSS scores indicated moderate neurological deficits (NIHSS 6–15). The results are consistent with the study by Zendrato and Barus, who noted that most ischemic stroke patients (57%) exhibited a high level of consciousness.[17] Ramadhani *et al.* also found that the NIHSS scores of ischemic stroke patients were highest in cases with moderate neurological deficits, which made up 45% of patients upon hospital admission.[7]

Several rating scales have been developed to assess the severity of strokes, including the Glasgow Coma Scale (GCS) and the National Institutes of Health Stroke Scale (NIHSS).[18] Both the GCS and the NIHSS scores predict mortality and morbidity with significant accuracy. Still, the NIHSS score is better at predicting outcomes like morbidity, mortality, and neurological outcomes in both supratentorial and infratentorial strokes. Conversely, the GCS score is mostly useful in predicting mortality and poor outcomes.[19]

Patient outcome

This study found that the majority of ischemic stroke patients with dyslipidemia had clinical improvements. These findings are congruent with research conducted by Rachmadiansyah *et al.*, which found that 78.51% of ischemic stroke patients improved after discharge, while 7.85% died.[20] Despite recent progress in the prevention and treatment of cardiovascular and cerebrovascular diseases, stroke continues to be a leading cause of mortality and disability worldwide. Post-stroke complications present a crucial opportunity for enhancing outcomes.[21] Over two-thirds of ischemic stroke patients either died or became functionally dependent five years post-stroke, with the mortality rate increasing beyond 30 days following the event.[22]

This study's strength is in its provision of a comprehensive descriptive overview of the features of ischemic stroke patients with dyslipidemia in a tertiary hospital in Indonesia. Nevertheless, there are certain constraints, including the study's restricted timeline, which may have overlooked significant trends or alterations in patient care. Furthermore, as the study depends on medical records, there is a risk of incomplete data, which thereby compromises the accuracy of our findings.

CONCLUSION

This study concluded that most dyslipidemia cases in patients with ischemic stroke were marked by low HDL-C values (< 40 mg/dl). The age range of the majority of patients was 56–65 years old. Most patients had their first stroke, with hypertension as the main comorbidity. Most patients have high consciousness (GCS 13–15) and moderate stroke severity (NIHSS 5–15). Most of them demonstrate improvement after receiving treatment.

Conflict of Interest
The authors have no conflicts of interest.

Ethic Consideration
The health research ethics committee at Dr. Soetomo General Academic Hospital granted ethical authorization. This research was approved on August 23, 2023, under the number 2346/121/4/VIII/2023.

Author Contributions

RAPP contributed to conceptualizing and designing, collecting and analyzing the data, and drafting the article. MSA, HT, and SS assisted to provide study materials, final approval of the article, and critical revision of the research for fundamental intellectual content.

REFERENCES

1. Murphy SJ, Werring DJ. Stroke: Causes and clinical features. *Medicine (Baltimore)*. 2020; 48(9):561–6. doi: 10.1016/j.mpmed.2020.06.002
2. Badan Penelitian dan Pengembangan Kesehatan. Laporan Nasional Riskesdas 2018. Jakarta; 2019. [Web page]
3. Laurent D, Small CN, Goutnik M, Hoh B. Ischemic Stroke. In: Acute Care Neurosurgery by Case Management. Cham: Springer International Publishing; 2022. p. 159–72. [Book]
4. Tsao CW, Aday AW, Almarzooq ZI, Alonso A, Beaton AZ, Bittencourt MS, et al. Heart disease and stroke statistics—2022 update: A report from the American Heart Association. *Circulation*. 2022; 145(8). doi: 10.1161/CIR.0000000000001052
5. Furie K. Epidemiology and primary prevention of stroke. *Contin Lifelong Learn Neurol*. 2020; 26(2):260–7. doi: 10.1212/CON.0000000000000831
6. Boehme AK, Esenwa C, Elkind MSV. Stroke risk factors, genetics, and prevention. *Circ Res*. 2017; 120(3):472–95. doi: 10.1161/CIRCRESAHA.116.308398
7. Rizki Ramadhani A, Saiful Ardhi M, Prajitno S. Profile of characteristic, risk factor, and stroke severity on infarction stroke patients. MNJ (Malang Neurol Journal). 2022; 8(2):109–12. doi: 10.21776/ub.mnj.2022.008.02.7
8. Davezac M, Buscato M, Zahreddine R, Lacolley P, Henrion D, Lenfant F, et al. Estrogen receptor and vascular aging. Front Aging. 2021 ;2. doi: 10.3389/fragi.2021.727380
9. Rizki Handayani, Moch Erwin Rachman, Nadra Maricar, Pratiwi Nasir Hamzah, Erni Pancawati. Karakteristik penderita stroke iskemik di Rumah Sakit Ibnu Sina Makassar tahun 2020-2021. *Fakumi Med J J Mhs Kedokt*. 2024; 3(12):910–6. doi: 10.33096/fmj.v3i12.321
10. Yusfita LY. Hubungan perilaku sedentari dengan sindrom metabolik pada pekerja. *Indones J Public Heal*. 2019; 13(2):145. doi: 10.20473/ijph.v13i2.2018.145-157
11. Reddin C, Murphy R, Hankey GJ, Judge C, Xavier D, Rosengren A, et al. Association of psychosocial stress with risk of acute stroke. *JAMA Netw Open*. 2022; 5(12):e2244836. doi: 10.1186/1476-069X-11-39
12. Prabawati RK, Pitaloka AS. Profil penderita stroke berulang Rumah Sakit Muhammadiyah Malang periode Juli-Agustus 2019. *Herb-Medicine J*. 2021 ;4(3):10–5. doi: 10.30595/hmj.v4i3.8147
13. Khanevski AN, Bjerkreim AT, Novotny V, Næss H, Thomassen L, Logallo N, et al. Recurrent ischemic stroke: Incidence, predictors, and impact on mortality. *Acta Neurol Scand*. 2019; 140(1):3–8. doi: 10.1111/ane.13093
14. Adam MF, Hutahean YO, Siagian LRD. Gambaran profil lipid dan rasio lipid pada pasien stroke iskemik barulang di RSUD Abdul Wahab Sjahranie Samarinda. *J Kedokt Mulawarman*. 2020;7(2):1–10. [Journal]
15. Yaghi S, Elkind MSV. Lipids and cerebrovascular disease. *Stroke*. 2015; 46(11):3322–8. doi: 10.1161/STROKEAHA.115.011164
16. Ali A, Obaid O, Akhtar N, Rao R, Tora SH, Shuaib A. Association between HDL levels and stroke outcomes in the Arab population. *Sci Rep*. 2024; 14(1):3071. doi: 10.1038/s41598-024-53613-z
17. Zendrato ACIP, Barus N. Gambaran dan tatalaksana stroke iskemik pasien rawat inap di RSU Royal Prima Medan tahun 2019. *J Kedokt STM (Sains dan Teknol Med*. 2021; 4(1):1–9. doi: 10.30743/stm.v4i1.63
18. Siniscalchi A. Use of stroke scales in clinical practice. *Turkish J Emerg Med*. 2022; 22(3):119–24. doi: 10.4103/2452-2473.348440
19. Padwale V, Chivate C, Kirnake V, Patil H, Kumar S, Pantbalekundri N. Comparative prognostic value of the National Institutes of Health Stroke Scale (NIHSS) and the Glasgow Coma Scale (GCS) in supratentorial and infratentorial stroke patients in Western India. *Cureus*. 2024; 6(7):e65778. doi: 10.7759/cureus.65778
20. Rachmadiansyah E. Gambaran keluarann klinis pasien stroke iskemik dengan faktor risiko hipertensi, diabetes mellitus dan dislipidemia di instalasi rawat inap departemen neurologi RSUD Dr. Soetomo periode Januari 2015 - Desember 2015. Universitas Airlangga; 2017. [Thesis]
21. Bustamante A, García-Berrocoso T, Rodriguez N, Llombart V, Ribó M, Molina C, et al. Ischemic stroke outcome: A review of the influence of post-stroke complications within the different scenarios of stroke care. *Eur J Intern Med*. 2016; 29:9–21. doi: 10.1016/j.ejim.2015.11.030
22. Sennfält S, Norrving B, Petersson J, Ullberg T. Long-Term survival and function after stroke: A longitudinal observational study from the Swedish stroke register. *Stroke*. 2019; 50(1):53–61. doi: 10.1161/STROKEAHA.118.022913