DOI: https://doi.org/10.53350/pjmhs202317291

ORIGINAL ARTICLE

Frequency of Dyslipidemia in Ischemic Strokes Involving Different Regions of Brain

ADNAN GHAFOOR[1], ALI GHAZANFAR[2], MARIA SARFRAZ[3], SYED JIBRAN ASHRAF[4], TANZIL-UR-REHMAN[5], AYESHA MUJTABA[6]
[1]Associate Professor, [2,5,6]Postgraduate Trainees, Department of Medicine, Fauji Foundation Hospital Rawalpindi
[3]Associate Professor, Department of Biochemistry, Rawal Institute of Health Sciences, Islamabad
[4]Assistant Professor, Department of Cardiology, United Medical & Dental College, Karachi
Correspondence to Dr. Ali Ghazanfar, E-mail: aligh003@gmail.com Cell: 0331-5567257

ABSTRACT

Background: Most strokes are ischemic; the type of artery involved can affect the prognosis and clinical symptoms. The risk factors for stroke include high blood pressure, diabetes, smoking, and elevated cholesterol. It has been demonstrated that lipid profile levels and the prognosis of stroke are related.
Aim: To determine the frequency of dyslipidemia in ischemic stroke patients based on the location of the infarct.
Study design: Cross-sectional study
Place and duration of study: Department of Medicine, Fauji Foundation Hospital Rawalpindi from 10 August to 10 January 2022.
Methods: Four hundred patients with MRI-proven ischemic stroke were enrolled. The blood samples were obtained, and a lipid profile was used to determine the lipid abnormalities (dyslipidemia).
Results: Middle cerebral artery involvement was the most frequently observed among the enrolled ischemic stroke patients, i.e., 54.8%. The overall frequency of dyslipidemia was 92.3%; hypercholesterolemia, hypertriglyceridemia, high LDL, and low HDL was present in 47.8%, 50.8%, 33.8%, and 93.8%, respectively. All patients with middle cerebral artery involvement had low HDL levels, 34.25% had high LDL levels, 41.10% had high triglyceride levels, and 54.79% had high cholesterol levels. A significant effect of age, gender, recurrent stroke, and location of infarct was observed on the frequency of dyslipidemia.
Conclusion: The frequency of dyslipidemia in ischemic stroke patients in Pakistan is relatively high. This emphasized how important it is to reduce these population-wide modifiable risk factors.
Keywords: Stroke, Dyslipidemia, Ischemic stroke, Lipid profile

INTRODUCTION

The leading global cause of death is still cardiovascular disease (CVD)[1]. The development of atherosclerotic disease is linked to increased levels of circulating total cholesterol (TC), low-density lipoprotein (LDL), non-high-density lipoprotein (non-HDL), and triglycerides (TG), as well as reduced HDL, in addition to other well-known risk factors like obesity, smoking, diabetes, and hypertension[2,4]. Elevated lipid levels persist throughout adolescence, raising the CVD risk and, consequently, morbidity and mortality[5]. Similar to childhood obesity, adult obesity and dyslipidemia are both positively correlated[6].

According to CDC, 1 in 6 deaths of CVD patients is contributed by stroke.[7] A hemorrhagic infarction or an ischemic may cause a stroke. Ischemic strokes, in which blood flow to the brain is interrupted, account for around 87% of all strokes[8]. A study found that ischemic stroke mortality was twice as high as hemorrhagic strokes[9]. Ischemic stroke can impact various brain arteries, and the type of artery involved can determine the clinical signs, symptoms, and prognosis. The most common artery affected is the middle cerebral artery and its territory[9].

Ischemic strokes have several different subtypes. According to studies, there may be varying degrees of correlation between each subtype and the various risk factors[10]. The cause of the recurrent stroke was the same as that of the initial stroke, demonstrating the inefficiency of the stroke prevention strategy. The long-term survival of stroke survivors is significantly impacted by the stroke's recurrence. Twenty to thirty percent of stroke patients have recurrent strokes as their underlying condition and not only have higher morbidity but also show that preventative therapy has failed[11].

The risk of stroke has been demonstrated to be influenced by gender and ethnicity, non-modifiable risk factors, as well as modifiable factors, including hypertension, elevated cholesterol levels, smoking, and diabetes[12,13]. These elements may also have an impact on post-stroke results. If the risk factors that led to the first stroke are not addressed, they could lead to another one. Over time, Asian populations' average blood cholesterol levels have progressively risen[12]. This implies that the risk of stroke has increased as well, and severe measures must be taken to mitigate this increase in risk. It has been demonstrated that lipid profile levels and the prognosis of stroke are related[14]. According to research, dyslipidemia was present in about 15.6% of people who had ischemic strokes[15]; however, a local examination discovered that it was 37.1%[16]. Patients who had ischemic strokes had a substantially higher rate of dyslipidemia (65.7%), according to Subburaj et al.[17] Due to a lack of a central registry and the restricted resources in the third world, dyslipidemia is a severely under-reported cause of stroke in Pakistan, necessitating laboratory tests to detect the condition.

Given that dyslipidemia is a frequent, modifiable risk factor for ischemic stroke, we sought to ascertain its frequency among patients with ischemic stroke.

Received on 10-08-2022
Accepted on 18-01-2023

MATERIALS AND METHODS

This cross-sectional study was conducted at Department of Medicine, Fauji Foundation Hospital Rawalpindi, Pakistan. The study duration was five months. With an anticipated prevalence of dyslipidemia of 39%[18] in ischemic stroke patients, a sample size of 370 was determined. Patients of all age groups with MRI-proven stroke were included in the study. While smokers and patients who had an incident of stroke ten days before study initiation were excluded from the study sample. Also excluded were the patients with undetermined imaging or in whom the artery involved couldn't be confirmed.

A total of 400 patients presented with an ischemic stroke were enrolled. The subject or a close relative completed an informed. A proforma was used to collect information about the patient's demographic and clinical characteristics. The patient's blood was drawn, and a lipid profile was used to determine whether or not the patient had dyslipidemia in the institution's lab. Patients with either triglyceride (TG) level <1.69mmol/dl, total cholesterol (TC) <5.2 mmol/dl, low-density lipoprotein (LDL) <3.36 mmol/dl, and high-density lipoprotein (HDL) >1.55mmol/dl were considered to have dyslipidemia.

The data was entered and analyzed through SPSS-22.0. The factors were stratified, and post-stratification Chi-square analysis was used to determine how categorical variables affected the frequency of dyslipidemia. While for continuous variables Independent T-test was used. A p-values <0.05 were regarded as significant.

RESULTS

Three hundred and sixty one (90.3%) were women. Patients' ages ranged from 13-81 years with a mean age of 65.64±9.63 years. Middle cerebral artery involvement was found in 54.8% of patients; all of these patients had low HDL levels, 34.25% had high LDL levels, 41.10% had high triglyceride levels, and 54.79% had high cholesterol levels (Table 1).

The overall frequency of dyslipidemia was 92.3%; hypercholesterolemia, hypertriglyceridemia, high LDL, and low HDL was present in 47.8%, 50.8%, 33.8%, and 93.8%, respectively (Table 2).

All patients with middle cerebral artery involvement had low HDL levels, 34.25% had high LDL levels, 41.10% had high triglyceride levels, and 54.79% had high cholesterol levels. Moreover, all patients with anterior inferior cerebellar artery involvement displayed abnormalities in all four lipid parameters (Fig. 1). There was a significant effect of age (t(33.14) = -4.76; p<0.01), gender (χ2=14.19; p<0.01), recurrent stroke (χ2=6.93; p<0.01), and arteries involved (χ2=95.7; p<0.01) on the frequency of dyslipidemia (Table 3).

Table 1: Baseline characteristics of the patients (n=400)

Variables	No. (%)
Gender	
Male	39 (9.8%)
Female	361 (90.3%)
Recurrent Stroke	
Yes	138 (34.5%)
No	262 (65.5%)
Artery involved	
Middle cerebral artery	219 (54.8%)
Posterior cerebral artery	9 (2.3%)
Multiple infarcts	44 (11%)
Lenticulostriate branches	66 (16.5%)
Basilar artery branches	33 (8.3%)
Anterior inferior cerebellar artery	5 (1.3%)
Anterior cerebral artery	10 (2.5%)
Posterior inferior cerebellar artery	14 (3.5%)

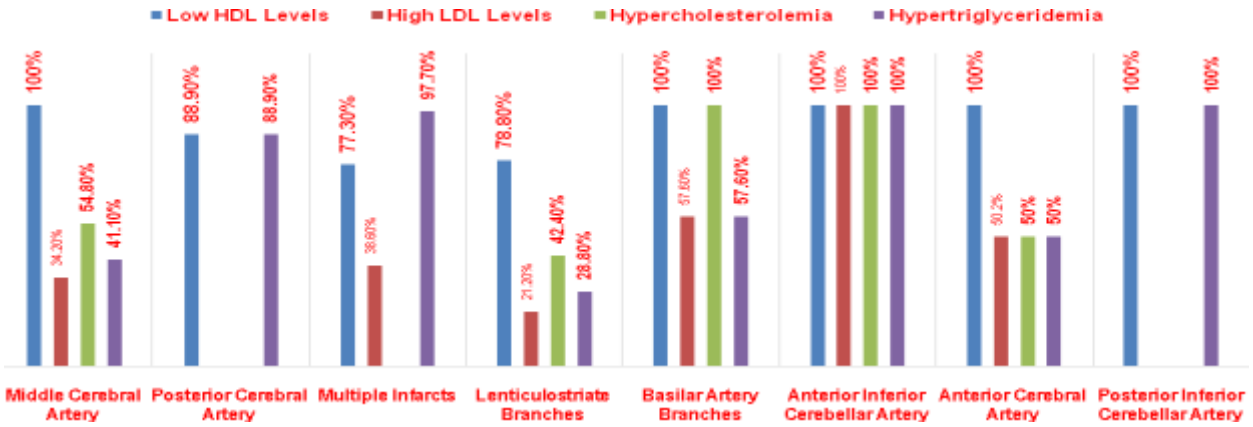
Table 2: Lipid profile among patients of ischemic stroke

Variables	No.	Mean±SD
Hypertriglyceridemia (>1.7 mmol/L)	203(50.8%)	2.79±1.13
Hypercholesterolemia (>5.2 mmol/L)	191(47.8%)	6.38±1.22
High LDL levels (>3.4 mmol/L)	135(33.8%)	4.11±0.744
Low HDL levels (<0.9 mmol/L)	375(93.8%)	1.04±0.27

Table 3: Frequency of dyslipidemia and its associated factors

Variable		Dyslipidemia	
		Present (n=293)	Absent (n=31)
Age (years)		66.29±9.16	57.94±11.73
Gender	Male	30 (8.1%)	9 (29%)
	Female	339 (91.9%)	22 (71%)
Recurrent stroke	Yes	134 (36.35)	4 (12.9%)
	No	235 (63.7%)	27 (87.1%)
Artery Involved	Middle cerebral artery	198(53.7)	21(67.7)
	Posterior cerebral artery	1(0.3)	8(25.8)
	Multiple infarcts	43(11.7)	1(3.2)
	Lenticulostriate branches	66(17.9)	-
	Basilar artery branches	33(8.9)	-
	Anterior inferior cerebellar artery	5(1.4)	-
	Anterior cerebral artery	9(2.4)	1(3.2)
	Posterior inferior cerebellar artery	14(3.8)	-

Fig. 1: Lipid profile abnormalities in ischemic strokes involving different parts of the brain



DISCUSSION

In this study, the prevalence of dyslipidemia in individuals who had an ischemic stroke was documented. According to WHO estimates from 2008, Southeast Asia has a 30.3% prevalence of dyslipidemia[19]. Our study also revealed that 92.3% of people who had an ischemic stroke afterward received a diagnosis of dyslipidemia. The findings were comparable to the existing literature; a study conducted in Pakistan revealed that 55% of the study group had dyslipidemia and an ischemic stroke[20].

Location affects the prevalence of cerebral artery stenosis. Asian populations have a substantially higher risk of intracranial artery stenosis than extracranial artery stenosis. Middle cerebral artery (MCA) stenosis is thought to be a factor in 30-50% of ischemic strokes. MCA is the most often afflicted channel[21], which is also apparent from the current study outcomes. Additionally, given the high frequency of progression, symptomatic intracranial artery stenosis appears to be particularly unstable[22].

A significant association between lipid abnormalities and the outcome of ischemic stroke has been defined, TC >6.22mmol/L (OR 3.013), TG >2.26 mmol/L (OR 0.883), LDL-C >4.14 mmol/L (OR 3.157), and HDL-C 1.04 mmol/L (OR 0.482). Furthermore, the Hosmer-Lemeshow goodness of fit test calibration of the model revealed no significant discrepancy between the observed and predicted results.[23] Early detection can help lower the prevalence of ischemic stroke, as dyslipidemia is a significant modifiable risk factor for this kind of stroke. A meta-analysis has also revealed a significant correlation between the incidence of dyslipidemia and

stroke among current and past smokers (odds ratio 1.32 and 1.32, respectively)[24].

Poupore et al[25] found raised LDL and higher lipoprotein levels in ischemic stroke patients. A study on African Americans found that raised HDL levels helped decrease stroke risk.[26] Consistent with these findings, 33.8% of the ischemic stroke patients in the present study had high LDL levels, and 93.8% of patients had low LDL levels, hypertriglyceridemia and hypercholesterolemia were also common, displaying significant abnormalities of lipid profile among ischemic stroke patients.

As per the existing literature, hypertension (74.3%), hyperglycaemia (64%), and dyslipidemia (57.1%) were the common risk factors for ischemic stroke[25]. Diabetes and hypertension are two other conditions known to increase the chance of having an ischemic stroke and dyslipidemia[27]. Furthermore, smoking history is also considered related to dyslipidemia, increasing the incidence of stroke. But the frequency of comorbidities and smoking status wasn't assessed in the present analysis; hence their contribution cannot be determined.

Also, dyslipidemia is more common in older age patients >65 years (63.2%)[28]. Consistent with these outcomes, we also found that the mean age of the patients with dyslipidemia was significantly higher than those without. Furthermore, more females were affected with ischemic stroke and presented with a higher frequency of dyslipidemia than males. Females tend to be at a greater risk for strokes than men. Factors like the age of menarche presence of eclampsia are also some factors that influence the development of stroke among women[29]. The prevalence of males and females was 79% and 21%, respectively, as reported by a local study. Furthermore, they found that the prevalence of dyslipidemia in men and women was 68.4% and 43.7%, respectively[28].

The study's major limitation is that it was a uni-centered investigation of a single population. Additionally, multicentre larger sample size studies are required to assess the prevalence of dyslipidemia and to further establish the link about brain region affected. The population data that is currently available for Pakistan is unreliable. Therefore, this study will benefit the existing body of knowledge.

CONCLUSION

There was a high frequency of dyslipidemia among ischemic stroke patients, a modifiable risk factor. Middle cerebral artery was the most affected territory. Hence early diagnosis and treatment, specifically among high-risk cases, would lessen the overall burden of this morbidity among stroke patients. The basic approach for reducing stroke risk in Pakistan includes modifying one's lifestyle.

Acknowledgment: The authors would like to acknowledge the Medical Affairs Department of Getz Pharma for their technical support and assistance in the publication process.

Conflict of interest: Nothing to declare

REFERENCES

1. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 2013;380(9859):2095–2128.
2. Perk J, De Backer G, Gohlke H, Graham I, Reiner Z, Verschuren M, et al. European Guidelines on cardiovascular disease prevention in clinical practice (version 2012). The Fifth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of nine societies and by invited experts). Eur Heart J 2012;33(13):1635–1701.
3. Nomikos T, Panagiotakos D, Georgousopoulou E, Metaxa V, Chrysohoou C, Skoumas I, et al. Hierarchical modelling of blood lipids' profile and 10-year (2002-2012) all-cause mortality and incidence of cardiovascular disease: the ATTICA study. Lipids Health Dis 2015;14:108.
4. Juhola J, Magnussen CG, Viikari JSA, Kähönen M, Hutri-Kähönen N, Jula A, et al. Tracking of serum lipid levels, blood pressure, and body mass index from childhood to adulthood: the Cardiovascular Risk in Young Finns Study. J Pediatr 2011;159(4):584–90.
5. Joshi SM, Katre PA, Kumaran K, Joglekar C, Osmond C, Bhat DS, et al. Tracking of cardiovascular risk factors from childhood to young adulthood - the Pune Children's Study. Int J Cardiol 2014;175(1):176–8.
6. Nielsen TRH, Gamborg M, Fonvig CE, Kloppenborg J, Hvidt KN, Ibsen H, et al. Changes in lipidemia during chronic care treatment of childhood obesity. Child Obes 2012;8(6):533–41.
7. Centers for Disease Control and Prevention. Underlying Cause of Death, 1999–2018. CDC WONDER Online Database. Centers for Disease Control and Prevention; 2018. Accessed March 12, 2020.
8. 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):e153–e639.
9. Abdu H, Tadese F, Seyoum G. Comparison of ischemic and hemorrhagic stroke in the medical ward of dessie referral hospital, northeast ethiopia: a retrospective study. Neurol Res Int 2021.
10. Kirshner HS. Differentiating ischemic stroke subtypes: risk factors and secondary prevention. J Neurol Sci 2009;279(1–2):1–8.
11. Hankey GJ. Secondary stroke prevention. Lancet Neurol [Internet] 2014;13(2):178–94.
12. Kim YD, Jung YH, Saposnik G. Traditional Risk Factors for Stroke in East Asia. J Stroke 2016;18(3):273–85.
13. Barthels D, Das H. Current advances in ischemic stroke research and therapies. Biochim Biophys Acta Mol Basis Dis 2020; 1866(4).
14. Xu T, Zhang JT, Yang M, Zhang H, Liu WQ, Kong Y, et al. Dyslipidemia and outcome in patients with acute ischemic stroke. Biomed Environ Sci 2014;27(2):106–10.
15. Alagarasu K. Immunomodulatory effect of vitamin D on immune response to dengue virus infection. In: Vitamins and Hormones. Academic Press, 2021 117: 239-52.
16. Abid NA, Khan SA, Taseer IH. Frequency of hyperlipidemia in patients presenting with ischemic stroke. Pak J Med Health Sci 2012; 6(2):423-7.
17. Subburaj T, Kumarasamy S, Velayudam S. Etiology and risk factors among young patients presenting with stroke in a tertiary care hospital in South India. Int J Res Med Sci 2017;5(3):1027.
18. Khan RSU, Nawaz M, Khan S, Raza HA, Nazir T, Anwar MS, et al. Prevalence of dyslipidemia in ischemic stroke patients: a single-center prospective study from Pakistan. Cureus 2022;14(6).
19. Lin CF, Chang YH, Chien SC, Lin YH, Yeh HY. Epidemiology of dyslipidemia in the Asia Pacific region. Int J Gerontol 2018;12(1):2-6.
20. Gul MM, Ali W, Iqbal S, Bano M, Memon A, Hussain W. Frequency of dyslipidemia in patients presented with ischemic stroke. Age (years) 2021;35(34):17.
21. Lee HN, Ryu CW, Yun SJ. Vessel-Wall magnetic resonance imaging of intracranial atherosclerotic plaque and ischemic stroke: a systematic review and meta-analysis. Front Neurol 2018;9:1032.
22. Ryu WS, Park SS, Kim YS, Lee SH, Kang K, Kim C, Sohn CH, Lee SH, Yoon BW. Long-term natural history of intracranial arterial stenosis: an MRA follow-up study. Cerebrovasc Dis 2014;38:290–6.
23. Tian XU, Zhang JT, Mei YA, Zhang H, Liu WQ, Yan KO, Tan XU, Zhang YH. Dyslipidemia and outcome in patients with acute ischemic stroke. Biomed Environ Sci 2014;27(2):106-10.
24. Pan B, Jin X, Jun L, Qiu S, Zheng Q, Pan M. The relationship between smoking and stroke: a meta-analysis. Medicine 2019;98(12).
25. Poupore N, Strat D, Mackey T, Brown K, Snell A, Nathaniel IT. Thrombolytic therapy in Ischemic Stroke Patients with a preceding transient ischemic attack (TIA) in a telestroke and non-telestroke setting. Neurol Clinc Neurosci 2020;8(5): 298–308.
26. Reina SA, Llabre MM, Allison MA, Wilkins JT, Mendez AJ, Arnan MK, et al. HDL Cholesterol and Stroke Risk: The Multi-Ethnic Study of Atherosclerosis. Atherosclerosis 2015; 243(1): 314.
27. Alloubani A, Saleh A, Abdelhafiz I. Hypertension and diabetes mellitus as a predictive risk factors for stroke. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2018 Jul 1;12(4):577-84.
28. Jaffar M, Rafique A, Khalid S, Waheed S. Frequency of dyslipidemia in ischemic stroke patients presented to tertiary care hospital of Lahore. PJMHS 2021;15(10):3417-9.
29. Maksimova MY, Airapetova AS. Gender differences in stroke risk factors. ZhNevrol PsikhiatrIm S SKorsakova 2019; 119(12): 58–64.