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Original Article

Ischemic Stroke and its Correlation with Low Blood Cholesterol Levels

Saima Rafique[1], Muhammad Aslam Rind Baloch[2*], Maria Nazir[2] and Muhammad Saleem[3]

[1]Department of Medicine, Bhitai Medical and Dental College, Mirpur Khas, Pakistan
[2]Department of Medicine, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan
[3]Department of Medicine, People's University of Medical and Health Sciences, Nawabshah, Pakistan

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***Corresponding Author:**
Muhammad Aslam Rind Baloch
Department of Medicine, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan.
draslamrind82@hotmail.com

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ABSTRACT

Ischemic stroke occurs as a result of blockage of blood supply to the brain. It causes damage of brain tissue due to less availability of oxygen and nutrients. HDL-C is a significant risk factor for ischemic stroke. **Objective:** To evaluate the low HDL-C levels in ischemic stroke hospitalized patients. **Methods:** It is a descriptive cross sectional retrospective study conducted at Liaquat University Hospital, Hyderabad, Pakistan. The anticipated association of abnormal HDL-C levels in ischemic stroke was assessed in 200 cases. The data were collected from hospital records, patients were confirmed for stroke on the basis of CT scan. This descriptive analysis was performed based on the lab findings of patients from hospital records. Medical history, CT scans and demographic information of patients was obtained from hospital records after taking data collection permission from hospital. **Results:** A low level of HDL-C was identified in 126 patients (64%) according to the study's results. When the HDL-C values of ischemic stroke patients were compared using the Chi-Square Test, the p value obtained was 0.0001. **Conclusions:** The majority of ischemic stroke patients had low serum HDL-C levels. This study suggests an association of low serum HDL-C levels with susceptibility or risk for ischemic stroke.

INTRODUCTION

Eighty-seven per cent of all stroke deaths are from "ischemic stroke," making stroke the second most common cause of death worldwide. An ischemic stroke occurs when a blood clot blocks any blood vessel that supplies blood to the brain, disrupting blood flow and causing a sudden loss of brain function [1]. HDL-Cholesterol (HDL-C) is a significant risk factor for ischemic stroke and is highly modifiable in connection to atherosclerosis among the various pathological processes that cause ischemic stroke [2]. The term "high-density lipoprotein" is HDL. It's a kind of lipoprotein that travels through your bloodstream. Lipids, fats, and proteins combine to form lipoproteins. Their primary function is to move lipids, such as cholesterol, to the body's cells where they are needed. Because of their chemical makeup, fats cannot flow through your blood on their own; they require a ride. To reach where they need to go, lipoproteins must assist them [3]. There is only one HDL and that is HDL-C. When discussing these particles and their impact on cardiac health, most of the people use both terms. Even while HDL particles include proteins and fats, people are more familiar with them because of the type of fat they carry i.e., cholesterol [4]. We do know that HDL particles can return extra cholesterol from the bloodstream to the liver. After that, the liver breaks down this cholesterol, which is then eliminated from body through faeces [5, 6]. HDL is a beneficial cholesterol because it helps eliminate excess cholesterol. But it accomplishes more than just that. To keep your cells healthy, HDL cholesterol also combats oxidants and inflammation. Additionally, it helps avoid blood clots, which

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in turn prevents stroke. Professional guidelines have advised the use of several systems and scales for the FAST6 (Face, Arms, Speech, Time) detection of stroke. These include the American Stroke Association, the National Stroke Association (US), the Department of Health (United Kingdom), Los Angeles pre-hospital stroke screen (LAPSS7), and the Cincinnati Pre-hospital Stroke Scale (CPSS8) [7]. The HDL-C Atherosclerosis Treatment Study (HATS) states that niacin is the medicine of choice for increasing serum HDL levels. In the US, stroke causes 134,000 fatalities and 795,000 cases of incidence each year. It is the leading cause of death in Brazil, and it has the highest mortality rates among Americans [8]. Khan et al. reported 43.2% of the ischemic stroke patients suffered low HDL-C levels in Pakistan [9]. Low HDL-C levels are a significant and highly changeable risk factor for ischemic stroke, which is caused by a variety of pathogenic processes. Currently, the most effective way to raise serum HDL-C levels is to combine statins with long-acting niacin.

The purpose of this study was to evaluate low HDL-C levels in ischemic stroke patients hospitalized in medical wards of Liaquat University Hospital in Hyderabad.

METHODS

This Descriptive Cross-sectional, retrospective study was carried out in Medical Wards of Liaquat University Hospital (LUH) Hyderabad. The anticipated frequency of HDL-Cholesterol (HDL-C) levels in ischemic stroke was assessed in 200 cases. The normal range of HDL-C is 35-65mg/dL for men and 35-80mg/dL for women for adults having age 20 years or above [10]. Convenient sampling technique was used to collect the samples. Patients older than 12 years of age and either sex with ischemic stroke were included in the study while the patients with hemorrhagic stroke and psychiatric disease were excluded from the study. The data were collected from hospital records. Patients were confirmed for stroke on the basis of CT scan after getting permission from Hospital. Reports of CT scans were also taken from the hospital records. The medical information regarding the patient's conventional risk factors, prescription use, and medical history was obtained. This study was conducted based on the lab findings. The data were analyzed using SPSS version-21.

RESULTS

Based on the age group stratification, it can be observed that 7 (3.5%) of the patients were under 35 years old, 26 (13%) were between the ages of 36 to 50, 78 (39%) were between the ages of 51 to 65, 77 (38.5%) were between the ages of 66 to 80, and 12 (6%) were older than 80 years. (Table 1).

Table 1: Age Distribution of the Patients

Age (years)	Frequency (%)
< 35	7 (3.5)
36-50	26 (13)
51-65	78 (39)
66-80	77 (38.5)
> 80	12 (6)

The gender distribution of the patients in our study reveals that 61% of the patients were males and 39% were females (Table 2).

Table 2: Gender Distribution of the Patients

Gender	Frequency (%)
Male	122 (61.0)
Female	78 (39.0)

In terms of clinical representation, 28% of patients had left-sided hemiplegia (paralysis of limbs on the left side of the body), 46% right-sided hemiplegia (paralysis of limbs on the right side of the body) and 52% aphasia (a language disorder)(Figure 1).

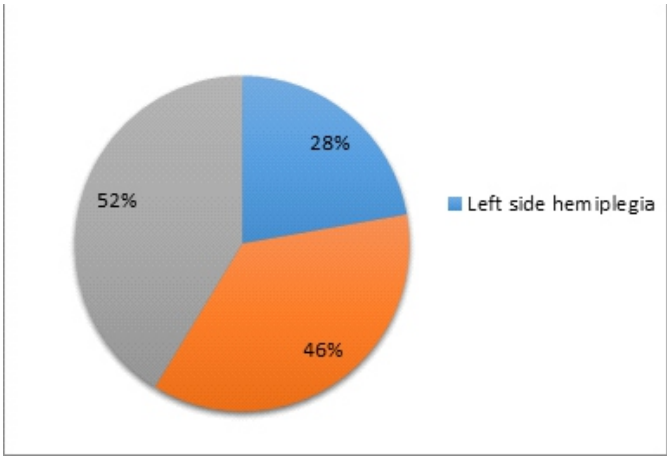

Figure 1: Clinical Representation of the Patients

A low level of HDL-C was identified in 126 patients (64%) according to the study results. When the HDL-C values of ischemic stroke patients were compared using the chi-square test, the p-value was found to be 0.0001 (Table 3).

Table 3: Ischemic Stroke and Patients with Low HDL-C Levels

Ischemic stroke	Patients with low HDL-C	p-value
200	126	0.0001

DISCUSSION

A prevalent condition with a high death rate in the general population is ischemic stroke. It is a global epidemic that poses a serious threat to public health in many nations. The most frequent kind of stroke is acute ischemic stroke, which accounts for 87% of all strokes. In Brazil, cerebrovascular illness is the leading cause of death and the United States has the greatest mortality rates,

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particularly among the black population and in the most impoverished areas [11-14]. Our goal was to determine whether dyslipidemia—specifically, low HDL-C levels—and ischemic stroke were related. Our study included two hundred individuals to determine the values of HDL-C in ischemic stroke. In our study, every patient was a young adult, older than 12 years, of either sex and never had an ischemic stroke before. Men are more likely than women to have a stroke, but women die from strokes more frequently than men do because women typically have strokes later in life. Gender, age, and heredity can all raise a person's risk of having a stroke [15]. Men are 25% more likely than women to have a stroke. However, women account for 60% of stroke-related deaths. Women tend to live longer than males, therefore when they suffer a stroke, they are often older and die from them more frequently [16]. Men made up 61% of the ischemic stroke cases in our study. The chance of getting a stroke rises dramatically with age. One of the most well-established risk factors for stroke is advanced age, and as the global population ages, there may be an increasing number of people at risk. According to WHO, population trends alone will likely lead to the annual cost of stroke events in EU nations [17]. Odds ratios were found to be significantly different in those with low HDL levels, indicating multivariate substantial variations in stroke risk. The study's findings revealed that 64% of the patients had low HDL-C levels [18]. Since ischemic stroke is a heterogeneous pathogenic entity with widely disparate routes, its clinical appearances might be difficult to differentiate. Strict management of modifiable risk factors such as high blood pressure, poor HDL-C, atrial fibrillation, LVH, diabetes mellitus, heavy smoking, the presence of a carotid bruit, alcohol misuse, and physical inactivity can result in a 99% reduction in stroke incidents [19]. The lipid profile plays a critical role in the effects of major artery atherosclerosis. In our study, reduced levels of HDL-C alone are noted as a critical single risk factor for ischemic stroke, which is corroborated by other studies [20]. Currently, the most effective medications are statins and long-acting niacin, especially when used together, which can increase HDL-C levels by up to 50% [21, 22]. It is important to note the study's shortcomings. The cases in our descriptive case series analysis were taken from medical wards where the patients were suffering from ischemic stroke; the involvement of HDL-C in the development of ischemic stroke is real but underappreciated [23]. High levels of HDL (over 60 mg/dL) have been linked to a lower risk of cardiovascular illnesses such as myocardial infarction and ischemic stroke, according to epidemiological research. Low levels of HDL—less than 40 mg/dL in men and less than 50 mg/dL in women—raise the risk of atherosclerotic illnesses [24]. According to our research, a significant risk factor for ischemic stroke is a low blood HDL-C level. Since none of the patients in our study had ever experienced a previous stroke or coronary artery disease, selection bias—which takes into account patients with severe illness—did not appear to be a contributing factor in our findings. Instead, all of the patients in our study had experienced an ischemic stroke for the first time [25]. Based on the data currently available, individuals diagnosed with atherosclerotic stroke and with HDL-C levels less than or equal to 35 mg/dl are recommended to get combined statin and long-acting niacin therapy to raise their HDL-C levels by 20%. Future research indicates that more advanced HDL-C-directed treatments may be able to raise serum HDL-C levels and enhance HDL-C activity [26].

CONCLUSIONS

According to the study's findings, the majority of ischemic stroke patients had low serum HDL-C levels. Therefore, we suggest a possible association of low HDL-C levels as a risk factor for ischemic stroke. Male gender is also a risk factor in current study.

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Authors Contribution

Conceptualization: MARB
Methodology:MARB
Formal analysis: SR, MARB, MN, MS
Writing-review and editing: SR, MARB, MS

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Mathers CD, Boerma T, Ma Fat D. Global and regional causes of death. British Medical Bulletin. 2009 Dec; 92(1): 7–32. doi:10.1093/bmb/ldp028.

[2] Saxena T. Cell death in stroke: Role of metabolism. Austin Journal of Cerebrovascular Disease and Stroke. 2017 May; 4(2): 1059. doi:10.26420/austinjcerebrovascdisstroke.2017.1059.

[3] Brewer HB. Increasing HDL cholesterol levels. New England Journal of Medicine. 2004 Apr; 350(15): 1491–4. doi:10.1056/nejmp048023.

[4] Harbison J, Massey A, Barnett L, Hodge D, Ford GA. Rapid ambulance protocol for acute stroke. The

DOI: https://doi.org/10.54393/pjhs.v4i12.1201

Lancet. 1999 Jun; 353(9168): 1935. doi:10.1016/s0140-6736(99)00966-6.

[5] Bhalla M. Challenges to utility of abbreviated MRI Brain Protocol designed for acute stroke. American Society of Neuroradiology (ASNR) 58th Annual Meeting 2020: ePosters. 2020 Jun; doi:10.26226/morressier.5e5e70e135f8e2df5e55a2b3.

[6] Studnek JR, Asimos A, Dodds J, Swanson D. Assessing the validity of the Cincinnati prehospital stroke scale and the medic Prehospital Assessment for Code Stroke in an Urban Emergency Medical Services Agency. Prehospital Emergency Care. 2013 Jul; 17(3): 348–53. doi:10.3109/10903127.2013.773113.

[7] De Luca A, Mariani M, Riccardi MT, Damiani G. The role of the Cincinnati Prehospital Stroke Scale in the emergency department: evidence from a systematic review and meta-analysis. Open Access Emergency Medicine. 2019 Jul; 147-59. 10.2147/OAEM.S178544.

[8] Brown BG, Zhao XQ, Chait A, Fisher LD, Cheung MC, Morse JS, *et al*. Simvastatin and niacin, antioxidant vitamins, or the combination for the prevention of coronary disease. New England Journal of Medicine. 2001 Nov; 345(22): 1583-92. doi:10.1016/s1062-1458(02)00657-8.

[9] Khan MN, Khan HD, Ahmad M, Umar M. Serum total and HDL-cholesterol in ischemic and hemorrhagic stroke. Annals of Pakistan Institute of Medical Sciences. 2014 Jan; 10(1): 22-6.

[10] University of Rochester Medical Center. Health Encyclopedia. [Last cited: 19th Jan 2024]. Available at: https://www.urmc.rochester.edu/encyclopedia.aspx.

[11] Mansur A de and Favarato D. Mortality due to cardiovascular diseases in women and men in the five Brazilian regions, 1980-2012. Arquivos Brasileiros de Cardiologia. 2016 Jul; 107: 137-46. doi:10.5935/abc.20160102.

[12] Tkucahev N. Solar alpha particles and death from ischemic heart disease. Research Review. 2023 Jun; 06(06): 1616-25. doi:10.52845/cmro/2023/6-6-2.

[13] Lotufo PA. Stroke is still a neglected disease in Brazil. Sao Paulo Medical Journal. 2015 Nov; 133(6): 457–9. doi:10.1590/1516-3180.2015.13360510.

[14] Schindel D, Schneider A, Grittner U, Jöbges M, Schenk L. Quality of life after stroke rehabilitation discharge: a 12-month longitudinal study. Disability and Rehabilitation. 2021 Jul 31; 43(16): 2332-41. doi:10.1080/09638288.2019.1699173.

[15] Zhang XX, Wei M, Shang LX, Lu YM, Zhang L, Li YD, *et al*. LDL-C/HDL-C is associated with ischaemic stroke in patients with non-valvular atrial fibrillation: a case-control study. Lipids in Health and Disease. 2020 Dec; 19(1): 1-1. doi:10.21203/rs.3.rs-60899/v1.

[16] Wang G, Jing J, Wang A, Zhang X, Zhao X, Li Z, *et al*. Non–high-density lipoprotein cholesterol predicts adverse outcomes in acute ischemic stroke. Stroke. 2021 Jun; 52(6): 2035–42. doi:10.1161/strokeaha.120.030783.

[17] Wang Y, Song Q, Cheng Y, Wei C, Ye C, Liu J, et al. Association between non-high-density lipoprotein cholesterol and haemorrhagic transformation in patients with acute ischaemic stroke. BMC Neurology. 2020 Dec; 20(1): 1-9. doi:10.1186/s12883-020-1615-9.

[18] Yuan S, Huang X, Ma W, Yang R, Xu F, Han D, *et al*. Associations of HDL-C/LDL-C with myocardial infarction, all-cause mortality, haemorrhagic stroke and Ischaemic Stroke: A Longitudinal Study based on 384 093 participants from the UK Biobank. Stroke and Vascular Neurology. 2023 Apr; 8(2). doi:10.1136/svn-2022-001668.

[19] Zhou P, Liu J, Wang L, Feng W, Cao Z, Wang P, *et al*. Association of small dense low-density lipoprotein cholesterol with stroke risk, severity and prognosis. Journal of Atherosclerosis and Thrombosis. 2020 Dec; 27(12): 1310–24. doi:10.5551/jat.53132.

[20] Ramírez-Moreno JM, Rebollo B, Macías-Sedas P, Valverde N, Parejo A, Felix-Redondo FJ, *et al*. Strength of association of classical vascular risk factors in young patients with Ischaemic Stroke: A case-control study. Neurología (English Edition). 2022 Oct; doi:10.1016/j.nrleng.2022.07.006.

[21] Hwang J, Lee Y, Kang K, Eun MY. Acute ischemic stroke caused by intracranial atherosclerosis associated with lorlatinib-induced dyslipidemia. Journal of Clinical Neurology. 2023 Jan; 19(1): 90. doi:10.3988/jcn.2023.19.1.90.

[22] Martinez-Majander N, Gordin D, Joutsi-Korhonen L, Salopuro T, Adeshara K, Sibolt G, *et al.* Markers of early vascular aging are not associated with cryptogenic ischemic stroke in the young: A case-control study. Journal of Stroke and Cerebrovascular Diseases. 2022 Sep; 31(9): 106647. doi:10.1016/j.jstrokecerebrovasdis.2022.106647.

[23] Duan R, Xue W, Wang K, Yin N, Hao H, Chu H, *et al.* Estimation of the LDL subclasses in ischemic stroke as a risk factor in a Chinese population. BMC Neurology. 2020 Dec; 20(1). 1-9. doi:10.1186/s12883-020-01989-6.

[24] Hossain A, Zahir KM, Haque MO and ul Azim MA. Study of ischemic stroke at young age (<25 years) of 50 patients admitted at SBMCH, Barisal. Journal of Medical Science And Clinical Research. 2020 Dec; 08(12): 90-95. doi:10.18535/jmscr/v8i12.15.

[25] Jaffar M, Rafique A, Khalid S, Waheed S. Frequency of dyslipidemia in ischemic stroke patients presented

DOI: https://doi.org/10.54393/pjhs.v4i12.1201

to Tertiary Care Hospital of Lahore. Pakistan Journal of Medical and Health Sciences. 2021 Oct; 15(10): 3417–9. doi:10.53350/pjmhs2115103417.

[26] Alkhaneen H, Alsadoun D, Almojel L, Alotaibi A, Akkam A. Differences of lipid profile among ischemic and hemorrhagic stroke patients in a tertiary hospital in Riyadh, Saudi Arabia: A retrospective cohort study. Cureus. 2022 May; 14(5). doi:10.7759/cureus.25540.