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Comparison of High Density Lipid (Hdl) Cholesterol Levels In Acute Ischemic Stroke Patients with and Without Diabetes Mellitus

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ABSTRACT

Objective: To compare HDL cholesterol levels among acute ischemic stroke patient with and without diabetes at tertiary care hospital of Rawalpindi.

Study Design: Cross sectional study.

Place And Duration of Study: Department of Neurology Pak Emirates Military Hospital Rawalpindi, Pakistan from Sep 2020 to Feb 2021.

Methodology: A total of 384 acute ischemic stroke patients were included in this study and non-probability convenience sampling technique was used to complete sample size for this study. A structured questionnaire was used for data collection. Data collected from available lab/hospital ward record and attendant. HDL cholesterol levels were compared between patients with diabetes and without diabetes among acute ischemic stroke patients.

Results: Study showed that overall sixty-two percent (62%) of acute ischemic stroke patients had diabetes and seventy-eight percent (78%) had low HDL cholesterol levels. Independent sample t-test showed significant association between HDL cholesterol level among acute ischemic stroke patients with diabetes (M = 0.77, S.D = 0.24) and with-out diabetes (M = 1.08, S.D = 0.44), *p*-value < 0.001.

Conclusion: Overall results of this study showed that diabetes does have significant association with HDL cholesterol levels among acute ischemic stroke patients.

Keywords: Acute ischemic stroke, Atherosclerosis, Diabetes, Disability adjusted life years (DALY's), High density lipoprotein cholesterol (HDL cholesterol).

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INTRODUCTION

Stroke, a major cause of disability that causes economic as well as social burden on family and country's productivity loss measured in terms of disability adjusted life years (DALY's). Stroke is the third leading cause of disability in developing as well as developed world and ranks second among the most common causes of death.[1] Stroke was defined by world health organization (WHO) on 1978 in Geneva conference as "A neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours".[2] A newer and broader definition of stroke has been proposed by American stroke association which includes evidence of permanent brain, spinal cord or retinal cell death due to vascular etiology along with pathological and radiological evidence with or without the presence of clinical symptoms.[3]

Acute ischemic stroke mostly occurs due to vascular pathology like thrombosis, embolism, systemic hypo-perfusion or cerebral venous thrombosis. Imbalance between good and bad cholesterol level is major contributing and augmenting factor along with other leading to thrombosis/ atherosclerosis causing acute and chronic vascular diseases.[4] HDL particles (good cholesterol) differ from others (bad cholesterol) in their ability of enhancing cholesterol efflux leading to lower serum cholesterol levels.[5,6] This HDL related cholesterol efflux varies among individuals, HDL concentration in blood and is independently associated with atherosclerotic vascular diseases.[7] A study done by Yun shen in 2019, found that there is an inverse association between HDL cholesterol and ischemic stroke risk among patients with diabetes.[8] In 2003, J. David curb et al finding the association between HDL cholesterol levels and risk of stroke among elderly men, found that there is nearly three times higher risk of stoke with low HDL

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cholesterol levels.[9] A study by Aleksandra found that acute ischemic stroke had lower HDL and higher LDL levels. In addition, significantly higher levels of LDL and lower levels of HDL were found in acute ischemic stroke fatalities compared with survivors.[10]

As per WHO, globally 5.5 million people dies from stroke every year whereas 5 million are left permanently disabled. More than 80% of stroke related deaths and disabilities occur in middle and low income countries. During the past four decades' incidence of stroke has been more than doubled in middle and low income countries. Pakistan shares a significant burden of this disease among Asian countries. Exact statistics are unavailable due to scarcity of literature and research on ischemic stroke, augmented by non-centralization of data in Pakistan. This study is focusing on HDL cholesterol levels among acute ischemic stroke patients with diabetes and other associated factors.

METHODOLOGY

The cross-sectional study was carried out in neurology department of PEM hospital Rawalpindi from Sept 2020 to Feb 2021. Sample size was 384 calculated by openepi sample size calculator with population prevalence (unknown) of 50% and margin of error as 5%. A structured questionnaire was used for data collection from available lab records and attendant. Non-probability convenience sampling technique was used to complete sample size for this study.

Inclusion Criteria: Acute ischemic stroke patients with available lab records admitted in ward were included.

Exclsuion Criteria: OPD patient and patients with no available lab records were not included in the study.

Hospital ethical review board (A/28/EC/69/2020) was approached and approval was obtained for the study. Variables as age, monthly income and HDL cholesterol levels were changed into categorical variables. For HDL cholesterol levels AFIP lab reference was used for making two groups, patient with HDL levels less than 1.0mol is termed as low HDL group while those with HDL levels greater than equal to 1.0mmol were termed as high HDL group. Participants were divided into two groups, acute ischemic stroke patients with diabetes and acute ischemic stroke patients without diabetes.

Statistical package for social services (SPSS) version 22 was used to analyse the data. For continuous variables, mean and standard deviation were reported, while for categorical variables frequencies and percentages were reported. Independent Samples t-test was carried out to find association between HDL cholesterol levels among acute ischemic stroke patients with and without diabetes. Differences between the groups were considered significant if p-value ≤ 0.05.

RESULTS

A total of 8 independent variables were assessed. Sociodemographic description of the participants for binary variables is shown in Table-I, for continuous variables shown in Table-II. Age was divided into two groups, less than 50 years were 200(52%) and greater than equal to 50 years were 184(48%). Males were 181(47%) and females were 203(53%). Out of 384 patients 159(41%) were smokers while 225(59%) were non-smokers. 206(54%) participants had monthly income greater than fifty thousand and 239(62%) had no history of regular daily exercise. 239(62%) of patients had diabetes. Mean HDL cholesterol levels among acute ischemic stroke patients with diabetes were 0.77 ±0.24 and among patients without diabetes was 1.08 ±0.44 (Table-III).

Table-I: Sociodemographic variables with frequency analysis

Variables		n(%)
Gender	Male	181(47%)
	Female	203(53%)
Age	< 50	200(52%)
	≥ 50	184(48%)
Diabetes	No	145(38%)
	Yes	239(62%)
Smoking	No	225(59%)
	Yes	159(41%)
Job Status	No	248(65%)
	Yes	136(35%)
Exercise	No	239(62%)
	Yes	145(38%)
Living Area	Rural	232(60%)
	Urban	152(40%)
Monthly Income	< 50,000	178(46%)
	≥ 50,000	206(54%)
HDL Levels	< 1.0mmol	300(78%)
	≥ 1.0mmol	84(22%)

Table-II: Comparison of Hdl Cholesterol Levels Among Patients with and Without Diabetes

Variables	Mean±S.D	*p*-value
Patients with Diabetes	0.77±0.24	< 0.001
Patients without Diabetes	1.08±0.44	

There was a significant difference in HDL cholesterol levels among acute ischemic stroke

patients with diabetes (M = 0.77, S.D = 0.24) and without diabetes (M = 1.08, S.D = 0.44), *p*-value<0.001. Independent variables as age, monthly income and residential area were not significant in this study. Whereas, non-modifiable risk factor as gender along with smoking, daily exercise history, job status came out to statistically significant as *p*-value < 0.05.

Table-III: Overall HDL Cholesterol levels with Sociodemographic Variables

Variables		Mean HDL Cholesterol Levels	*p*-value
Gender	Male	0.81±0.31	<0.001
	Female	0.96±0.39	
Age	< 50	0.87±0.35	0.244
	≥ 50	0.91±0.38	
Smoking	No	0.99±0.41	<0.001
	Yes	0.74±0.20	
Job Status	Jobless	0.96±0.40	<0.001
	Working	0.75±0.24	
Exercise	No	0.92±0.38	0.01
	Yes	0.83±0.33	
Living Area	Rural	0.90±0.37	0.46
	Urban	0.87±0.35	
Monthly Income	< 50,000	0.92±0.37	0.07
	≥ 50,000	0.86±0. 36	

DISCUSSION

Results of this study showed that acute ischemic stroke patients with diabetes had lower HDL cholesterol levels which is considered bad for health compared to patients without diabetes and were consistent with the previous researches. HDL cholesterol level among acute ischemic stroke patients is significantly associated with diabetes, *p*-value<0.05.

Literature review shows mixed findings of HDL cholesterol levels with sociodemographic factors like age, gender, socioeconomic status, marital status, living in rural or urban areas, physically active occupation or sedentary occupation, education level, healthy food intake, alcohol intake and cessation of smoking. A study done in 2016 by Sabahelkhier MK on total cholesterol and HDL cholesterol levels found low HDL levels with high total cholesterol levels among diabetics are at high risk of cerebrovascular diseases *p*-value<0.05.[11]

In 2014, a study done by LuoY and others to find out relation between HDL levels among acute ischemic stroke patients and diabetes showed significant association between HDL levels and diabetes *p*-value < 0.05. Patient with diabetes had lower HDL levels compared to patients without diabetes. Decreased HDL cholesterol levels increases the risk of ischemic stroke compared to high HDL levels group, (0R = 2.11, CI 1.91 – 3.74).[12] Yurong zhang *et al* in 2012, done a study to find association between total and HDL cholesterol with stroke found that low levels of HDL cholesterol and high levels of total cholesterol were associated with increased risk of ischemic stroke, *p*-value < 0.0513.

In 2001, Sacco et al found that HDL cholesterol is inversely associated with risk of ischemic stroke among diabetes patients and found a protective effect of HDL (at least 35mg/dl) on ischemic stroke, OR = 0.53.[14] A retrospective cohort study done by Gary Rothbard in 2020, on association between HDL cholesterol levels and risk of stroke, myocardial infarction and mortality found that cohort with low mean levels of HDL cholesterol had higher rates of diabetes and hypertension compared to other groups at baseline. Individuals of this low mean HDL level group were at greater risk of stoke (Hazard ratio 1.23, CI 1.41–1.54) compared to other groups.[15]

A study by Yuehua et al in 2013 for determining association between HDL levels and acute ischemic stroke found that patients with low HDL cholesterol levels had the highest risk of developing ischemic stroke (OR = 1.52, CI 1.17-1.63) compared to patients with highest HDL cholesterol (≥1.32mmol/L) after adjustment of covariates16. A collaborative study among research centres in Europe found that higher HDL cholesterol is associated with lower risk of acute ischemic stroke (OR= 0.68, CI 0.40 – 1).[16] Difference between men and women in association of HDL with stroke was noted seemed to differ mainly due to smoking.[17] A systemic review done by Pierre et al in 2008 showed association between higher levels of HDL cholesterol and decreased risk of acute ischemic stroke.[18]

The study had limitations like easy accessibility, affordability of health services, hypertension with other chronic disease, body mass index, ethnicity and other non-modifiable factors, LDL and triglyceride levels. Age and gender which can be confounding factors were not evaluated in this study. However, study showed few augmenting factors that can lead to acute ischemic stroke or other vascular diseases, highlighted the lack of research in this field, non-centralization of data, unknown incidence and prevalence. All these factors are questioning the capability and capacity of health system and a major hindrance in achieving the health related sustainable developmental goal.

CONCLUSION

Results of this study showed statistically significant difference in HDL cholesterol levels among acute ischemic stroke patients with and without diabetes. Other factors as gender, smoking, job status and exercise were also found to be statistically significant. Stroke society of Pakistan need to focus on centralization of data with extensive surveys for incidence and prevalence of acute ischemic stroke and its associated factors. Incident reporting along with incorporation of public health department in the health system for health promotion and prevention of such diseases, can help in reducing the morbidity and mortality leading to healthier life and increased life expectancy.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SK & MNAK: Data acquisition, data analysis, critical review, approval of the final version to be published.

NS & AN: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

MZH & HMB: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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