

## Dyslipidemia among Patients with Ischemic Stroke Admitted to the Department of Medicine of a Tertiary Care Centre

Tunam Khadka,<sup>1</sup> Ganesh Kumar Giri,<sup>1</sup> Pasang Sherpa,<sup>2</sup> Urbi Ghimire,<sup>1</sup> Shamin Parajuli,<sup>3</sup> Ashok Pudasaini,<sup>3</sup> Sajjan Shrestha<sup>1</sup>

<sup>1</sup>Kathmandu Medical College and Teaching Hospital, Sinamangal, Kathmandu, Nepal, <sup>2</sup>Department of Medicine, Nepal Medical College and Teaching Hospital, Jorpati, Kathmandu, Nepal, <sup>3</sup>Department of Medicine, Upendra Devkota Memorial National Institute of Neurological and Allied Sciences, Bansbari, Kathmandu, Nepal.

### ABSTRACT

**Introduction:** Sudden neurological deficits due to an acute focal vascular injury of the central nervous system is stroke. It is a major cause of morbidity and mortality. Dyslipidemia is any abnormality in the parameter of the lipid profile which has been associated with stroke. The aim of this study was to find out the prevalence of dyslipidemia among patients with ischemic stroke in the Department of Medicine of a tertiary care centre.

**Methods:** A descriptive cross-sectional study was conducted in a tertiary care centre among admitted ischemic stroke patients from 5 August 2022 to 14 March 2023 after obtaining ethical approval from the Institutional Review Committee. Overnight fasting blood samples were collected for lipid profile. Convenience sampling method was used. The point estimate was calculated at a 95% Confidence Interval.

**Results:** Among 79 ischemic stroke patients, 42 (53.16%) (42.09-64.23, at 95% Confidence Interval) had dyslipidemia where high cholesterol was seen in 21 (50%), high triglyceride in 22 (52.38%), high low-density lipoprotein 14 (33.33%) and low high-density lipoprotein in 20 (47.61%).

**Conclusions:** The prevalence of dyslipidemia among ischemic stroke patients was lower than the similar studies done in similar settings.

**Keywords:** *cross-sectional studies; dyslipidemia; hyperlipidemias; ischemic stroke.*

### INTRODUCTION

Stroke is a neurological deficit due to an acute focal vascular injury of the central nervous system including cerebral infarction, intracerebral haemorrhage, and subarachnoid haemorrhage, and is a major cause of morbidity and mortality worldwide.<sup>1</sup> The majority of patient suffers from ischemic stroke rather than hemorrhagic.<sup>2</sup> Based on disability-adjusted life years, stroke is one of the major causes of death and is among the top five diseases in Nepal.<sup>3</sup> The mean age of stroke patients in Nepal is between 59 and 62 years, with males affected more frequently.<sup>4</sup>

Dyslipidemia seems to be a major abnormal finding in stroke patients.<sup>2</sup> Dyslipidemia is a group of metabolic

derangements characterised by any or combination of elevated low-density lipoprotein cholesterol, total cholesterol, triglycerides, and low high-density lipoprotein.<sup>5</sup> There was a three-fold increase in the incidence of stroke in patients with dyslipidemia.<sup>6</sup>

The aim of this study was to find out the prevalence of dyslipidemia among patients with ischemic stroke in the Department of Medicine of a tertiary care centre.

**Correspondence:** Dr Tunam Khadka, Kathmandu Medical College and Teaching Hospital, Sinamangal, Kathmandu, Nepal. Email: khadkatunam1@gmail.com, Phone: +977-9868000202.

## METHODS

This was a descriptive cross-sectional study conducted in the Department of Medicine of Kathmandu Medical College and Teaching Hospital, Sinamangal, Kathmandu, Nepal among the cases of ischemic stroke that had been diagnosed in the hospital between from 5 August 2022 to 14 March 2023. Ethical approval was obtained from the Institutional Review Committee of the same institute (Reference number: 4082022/02). The study included patients who had developed a sudden neurological deficit affecting a vascular territory, with sustained symptoms lasting more than 24 hours and evidence of a stroke on magnetic resonance imaging or non-contrast computed tomography scan, as confirmed by a neurologist. Patients who were discharged or referred to another hospital, and patients who did not undergo neuroimaging were excluded from this study. Convenience sampling method was used. The sample size was calculated using the following formula:

$$n = Z^2 \times \frac{p \times q}{e^2}$$

$$= 1.96^2 \times \frac{0.80 \times 0.20}{0.09^2}$$

$$= 76$$

Where,

n= minimum required sample size

Z= 1.96 at 95% Confidence Interval (CI)

p= prevalence taken from the previous study as, 80%<sup>7</sup>

q= 1-p

e= margin of error, 9%

The minimum required sample size was 76. However, the final sample size taken was 79.

Overnight fasting blood samples were collected from the patient after 8-10 hours of fasting. Lipid profiles were measured where total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), triglyceride (TG) and low-density lipoprotein cholesterol (LDL-C) were calculated and measured.

Dyslipidemia is defined according to the third report of the National Cholesterol Education Program (NCEP) Adult Treatment Panel III. One or more of the following is diagnosed as dyslipidemia.<sup>7</sup>

1. LDL Cholesterol  $\geq 130$  mg/dl
2. Total Cholesterol  $\geq 200$  mg/dl
3. Triglycerides  $\geq 150$  mg/dl
4. HDL Cholesterol  $\leq 40$  mg/dl

Data were entered in Microsoft Excel 2016 and analysed using IBM SPSS Statistics version 21.0. The point estimate was calculated at a 95% CI.

## RESULTS

Among 79 patients with ischemic stroke, dyslipidemia was seen in 42 (53.16%) (42.09-64.23, 95% CI). High cholesterol was seen in 21 (50%) with mean total Cholesterol of  $188.48 \pm 49.26$  mg/dl, high triglyceride in 22 (52.38%) with mean triglyceride of  $160.83 \pm 69.44$  mg/dl, high LDL in 14 (33.33%) with mean LDL of  $110.86 \pm 39.68$  mg/dl, and low HDL in 20 (47.61%) with mean HDL of  $43.33 \pm 8.68$  mg/dl.

The mean age of the ischemic stroke patients presenting with dyslipidemia in this tertiary care centre was  $60 \pm 14.93$  years with a maximum of 87 years and a minimum of 20 years out of which 23 (54.76%) belonging to the age group less than 60 years and 19 (45.24%) were above 60 years.

Gender wise there was male predominance with males being 23 (54.76%) and females 19 (45.24%). A total of 15 (35.71%) males and 6 (14.29%) females had high total cholesterol, 12 (28.57%) males and 10 (23.81%) females had high triglyceride, 9 (21.43%) males and 5 (11.90%) females had high low-density lipoprotein, and 6 (14.29%) male and 14 (33.33%) female had low high-density lipoprotein (Table 1).

**Table 1. Lipid profile among patients with dyslipidemia (n= 42).**

Lipid Profile	Age		Sex		Total n (%)
	<60 years n (%)	>60 years n (%)	Male n (%)	Female n (%)	
High total cholesterol	12 (28.57)	9 (21.43)	15 (35.71)	6 (14.29)	21 (50)
High triglycerides	13 (30.95)	9 (21.43)	12 (28.57)	10 (23.81)	22 (52.38)
High LDL cholesterol	6 (14.29)	8 (19.05)	9 (21.43)	5 (11.90)	14 (33.33)
Low HDL cholesterol	10 (23.81)	10 (23.81)	6 (14.29)	14 (33.33)	20 (47.61)

Among 42 patients with dyslipidemia, 23 (54.76%) of the ischemic stroke patients were smokers, 12 (28.57%) of them were male and 11 (26.19%) were female. Whereas 10 (23.81%) were alcoholic, 10 (23.81%) were

male and none of the ischemic stroke female with dyslipidemia were alcoholic. In our study 37 (88.10%) patient with 21 (50%) male and 16 (38.10%) female were having first episode of ischemic stroke (Table 2).

**Table 2. Different characteristics of the ischemic stroke patients (n= 42).**

Characteristics	n (%)	Sex	
		Male n (%)	Female n (%)
Smoking	23 (54.76)	12 (28.57)	11 (26.19)
Alcoholic	10 (23.81)	10 (23.81)	-
<b>Stroke type</b>			
First Episode	37 (88.10)	21 (50)	16 (38.10)
Recurrent	5 (11.90)	2 (4.76)	3 (7.14)

In our study 30 (71.43%) of the patient presented with weakness of the body in the form of hemiparesis, upper or lower limb weakness unilateral or bilateral, 29 (69.05%) presented with slurring of speech, 9 (21.43%) with facial deviation, 5 (11.90%) with headache, 3 (7.14%) with loss of consciousness and 3 (7.14%) with a tingling sensation. In this study, multi-morbidity was found in 23 (54.76%) patients having more than one disease. Hypertension (HTN) was the commonest risk factor with a total of 18 (42.86%) patients having been diagnosed with HTN, 13 (30.95%) had type 2 diabetes mellitus (T2DM) followed by 3 (7.14%) with cardiovascular disease (CVD), 3 (7.14%) had chronic obstructive pulmonary disease (COPD) and 1 (2.38%) with chronic kidney disease (CKD) (Table 3).

**Table 3. Presenting complaints and comorbidity in ischemic stroke patient (n= 42).**

Variables	n (%)	Sex	
		Male n (%)	Female n (%)
<b>Presenting complaints</b>			
Headache	5 (11.90)	3 (7.14)	2 (4.76)
Slurring of speech	29 (69.05)	15 (35.71)	14 (33.33)
Weakness of body	30 (71.43)	15 (35.71)	15 (35.71)
Facial deviation	9 (21.43)	7 (16.67)	2 (4.76)
Loss of consciousness	3 (7.14)	1 (2.38)	2 (4.76)
Tingling sensation	3 (7.14)	2 (4.76)	1 (2.38)
<b>Comorbidity</b>			
T2DM	13 (30.95)	8 (19.05)	5 (11.90)
HTN	18 (42.86)	10 (23.81)	8 (19.05)
CVD	3 (7.14)	-	3 (7.14)
COPD	3 (7.14)	-	3 (7.14)
CKD	1 (2.38)	1 (2.38)	-

## DISCUSSION

The prevalence of dyslipidemia among the ischemic stroke patients in our study was 42 (53.16%) with hypertriglyceridemia the most common finding constituting 22 (52.38%) which was similar to the finding from a study in our country 58.33%.<sup>7</sup>

Dyslipidemia is a well-known risk factor for cardiovascular and cerebrovascular events worldwide. Therefore, preventing and managing dyslipidemia can help to reduce the global burden of stroke.<sup>8</sup> Unfortunately, there is limited information available on the prevalence, morbidity, and mortality of stroke in Nepal beyond urban areas, and no official reports have been published on the epidemiology of stroke throughout the country.<sup>4</sup> However, changes in the epidemiological profile of stroke have been observed in clinical practice and confirmed by a study done in a similar setting.<sup>6</sup> In developing countries such as Nepal, the incidence rate of stroke has increased by 100%, whereas in developed countries, it has decreased by 42% over the last four decades.<sup>9</sup> This increase in stroke incidence is largely attributed to atherosclerosis, which is a major contributor to ischemic stroke.<sup>10</sup> However, dyslipidemia is a modifiable risk factor for stroke, and therefore, its management can play a significant role in reducing stroke incidence.

Our findings of a 53.16% prevalence of dyslipidemia in ischemic stroke patients are consistent with a study conducted in northeast China, which found a prevalence of 62.1% in ischemic stroke patients.<sup>10</sup> These results highlight the importance of identifying and managing dyslipidemia in stroke patients, particularly those with ischemic stroke, to reduce the risk of recurrent events and improve overall outcomes.

The relative risk of stroke associated with elevated serum cholesterol is high, as well as its population-attributable risk given the increase in incidence in elderly populations.<sup>11</sup> A study in Japan among 2,351 Japanese inhabitants aged  $\geq 40$  years of age showed increased incidences of atherothrombotic and lacunar infarctions significantly with the increasing LDL cholesterol level, but no such associations were observed for cardioembolic infarction. Thus, it depicts a positive relation of increased LDL with small artery stroke as high LDL is usually implicated in atherosclerosis.<sup>12</sup> In our study, the mean age of ischemic stroke associated with dyslipidemia was  $60 \pm 14.93$  years with most patients less than 60 years 23 (54.76%). A comparable age was also present in studies done in Nepal and India.<sup>13</sup>

One of the studies showed that men experience more ischemic stroke than females, but females experience more subarachnoid hemorrhage. In terms of stroke onset, women are on average 4 years older than men at the age of ischemic stroke.<sup>14</sup> Our study shows the prevalence of ischemic stroke is more 23 (54.76%) in men than 19 (45.24%) in females, thus men have a higher prevalence of ischemic stroke than females, similar to the study done in a similar setting.<sup>14</sup> The Asia Pacific Cohort Studies Collaboration found a 25% increase in ischemic stroke rates for every 1 mmol/L increase in total cholesterol.<sup>15</sup> Similar study found the prevalence of dyslipidemia in the eastern part of our country, in a similar setting, to be 46.05%, with high triglyceride (TG) being the most commonly deranged parameter similar to the finding depicted by our study 22 (52.38%).<sup>16</sup> Our study found that the prevalence of ischemic stroke was higher in patients with high TG levels and lower in patients with high levels of LDL.

Our study revealed the weakness of the body 30 (71.43%) in the form of hemiparesis of the upper limb or lower limbs to the commonest presenting complaint followed by slurring of speech 29 (69.04%) and facial deviation 9 (21.43%) similar to the finding done in a similar setting, which showed hemiparesis 59.16% as the commonest complaint followed by slurring of speech.<sup>7</sup> We find 23 (54.76%) of the ischemic stroke patients to have multimorbidity with HTN being the commonest associate, which was quite less compared

to the findings of a similar study.<sup>17</sup>

Ischemic stroke is multifactorial and requires various integrated approaches. So early screening, monitoring and intervention of the different risk factors as well as awareness will help in combating the burden of the disease as it is one of the leading causes of morbidity and disability in the Asian population. Therefore, a more substantial, in-depth, and multicentered prospective investigation should be conducted to examine the severity of the disease and its relationship with various variables in the context of the Nepalese community.

The findings from our study cannot reflect the general population because it was a single-centered study with a small sample size. This was a descriptive cross-sectional study so association with risk factors cannot be established.

## CONCLUSIONS

The prevalence of dyslipidemia in ischemic stroke patients was lower than the similar studies done in similar settings. Modifiable risk factors also play an important role in disease causation so timely action and knowledge regarding the risk factor can reduce the disease burden.

**Conflict of Interest: None.**

## REFERENCES

1. Donkor ES. Stroke in the 21st century: a snapshot of the burden, epidemiology, and quality of life. *Stroke Res Treat.* 2018;2018:3238165. [[PubMed](#) | [Full Text](#) | [DOI](#)]
2. Saini V, Guada L, Yavagal DR. Global epidemiology of stroke and access to acute ischemic stroke interventions. *Neurology.* 2021;97(20 Suppl 2):S6–16. [[PubMed](#) | [Full Text](#) | [DOI](#)]
3. Pyakurel M, Bhattarai S, Joshi B, Koju RP, Shrestha A. Burden of Stroke in Nepal: Findings from Global Burden of Disease Dataset 2017. *Kathmandu Univ Med J (KUMJ).* 2021;19(75):11-7. [[PubMed](#) | [Full Text](#)]
4. Shaik MM, Loo KW, Gan SH. Burden of stroke in Nepal. *Int J Stroke.* 2012;7(6):517–20. [[PubMed](#) | [Full Text](#) | [DOI](#)]
5. Opoku S, Gan Y, Fu W, Chen D, Addo-Yobo E, Trofimovitch D, et al. Prevalence and risk factors for dyslipidemia among adults in rural and urban China: findings from the China National Stroke Screening and prevention project (CNSSPP). *BMC Public Health.* 2019 Nov;19(1):1500. [[PubMed](#) | [Full Text](#) | [DOI](#)]
6. Thapa A, Kc B, Shakya B, Yadav DK, Lama K, Shrestha R. Changing epidemiology of stroke in Nepalese population. *Nepal Journal of Neuroscience.* 2018;15(1):10–8. [[Full Text](#) | [DOI](#)]
7. Baral S, Pokhrel A, B K SK, Kshetri R, Regmi P, Gyawali P. Dyslipidemia among patients with ischemic stroke in the department of medicine of a tertiary care centre: A descriptive cross-sectional study. *J Nepal Med Assoc.* 2022 Jun 1;60(250):511–6. [[PubMed](#) | [Full Text](#) | [DOI](#)]
8. Alloubani A, Nimer R, Samara R. Relationship between hyperlipidemia, cardiovascular disease and stroke: a systematic review. *Curr Cardiol Rev.* 2021;17(6):e051121189015. [[PubMed](#) | [Full Text](#) | [DOI](#)]
9. Feigin VL, Lawes CMM, Bennett DA, Barker-Collo SL, Parag V. Worldwide stroke incidence and early case fatality reported in 56 population-based studies: a systematic review. *Lancet Neurol.* 2009 Apr; 8(4):355–69. [[PubMed](#) | [Full Text](#) | [DOI](#)]

10. Zhang F-L, Guo Z-N, Wu Y-H, Liu H-Y, Luo Y, Sun M-S, et al. Prevalence of stroke and associated risk factors: a population based cross sectional study from northeast China. *BMJ Open*. 2017 Sep 3;7(9):e015758. [[PubMed](#) | [Full Text](#) | [DOI](#)]
11. Sarti C, Kaarisalo M, Tuomilehto J. The relationship between cholesterol and stroke: implications for antihyperlipidaemic therapy in older patients. *Drugs Aging*. 2000 Jul;17(1):33-51. [[PubMed](#) | [Full Text](#) | [DOI](#)]
12. Imamura T, Doi Y, Arima H, Yonemoto K, Hata J, Kubo M, et al. LDL cholesterol and the development of stroke subtypes and coronary heart disease in a general Japanese population: the Hisayama study: The Hisayama study. *Stroke*. 2009 Feb; 40(2):382-8. [[PubMed](#) | [Full Text](#) | [DOI](#)]
13. Dalal PM, Malik S, Bhattacharjee M, Trivedi ND, Vairale J, Bhat P, et al. Population-based stroke survey in Mumbai, India: incidence and 28-day case fatality. *Neuroepidemiology*. 2008; 31(4):254-61. [[PubMed](#) | [Full Text](#) | [DOI](#)]
14. Kapral MK, Fang J, Hill MD, Silver F, Richards J, Jaigobin C, et al. Sex differences in stroke care and outcomes: results from the Registry of the Canadian Stroke Network. *Stroke*. 2005 Apr;36(4):809-14. [[PubMed](#) | [Full Text](#) | [DOI](#)]
15. Zhang X, Patel A, Horibe H, Wu Z, Barzi F, Rodgers A, et al. Cholesterol, coronary heart disease, and stroke in the Asia Pacific region. *Int J Epidemiol*. 2003 Aug;32(4):563-72. [[PubMed](#) | [Full Text](#) | [DOI](#)]
16. Shah SP, Shrestha A, Pandey SR, Sigdel K, Sah N, Panthi S, et al. Dyslipidemia in acute non-cardioembolic ischemic stroke patients at a tertiary care centre: a descriptive cross-sectional study. *J Nepal Med Assoc*. 2022 Mar 11;60(247):241-5. [[PubMed](#) | [Full Text](#) | [DOI](#)]
17. Khadka T, Giri GK, Mandal D, Shrestha A, Dhungel A, Vaidya A. Multimorbidity in diabetic patients admitted to a tertiary care center: a descriptive cross-sectional study. *J Nepal Med Assoc*. 2023 Jan 1;61(257):50-3. [[PubMed](#) | [Full Text](#) | [DOI](#)]

© The Author(s) 2023.

This work is licensed under a Creative Commons Attribution 4.0 International License. The images or other third party material in this article are included in the article's Creative Commons license, unless indicated otherwise in the credit line; if the material is not included under the Creative Commons license, users will need to obtain permission from the license holder to reproduce the material. To view a copy of this license, visit <https://creativecommons.org/licenses/by/4.0/>