

A Study of Correlation Between Serum Triglyceride Levels and Severity Of Stroke

Dhanju AS¹, Kathait A², Salwan S³, Chhabra A¹

¹Professor, Department of Medicine, GMC Amritsar, Panjab, Indai

²Junior Resident, Department of Medicine, GMC, Amritsar, Panjab, India

³Associate Professor, Department of Medicine, GMC Amritsar, Panjab, India

Received: 31-10-2021 / Revised: 28-12-2021 / Accepted: 09-02-2022

Corresponding author: Dr. Ajay Chhabra

Conflict of interest: Nil

Abstract

Introduction: Stroke is one of the leading causes of mortality and morbidity. Dyslipidemia in the form of triglyceridemia and hypercholesterolemia is an increasingly recognised condition in vascular diseases. This study aims to find the correlation of triglycerides with stroke severity.

Aims and Objectives: The aim of the study was to determine correlation between serum triglyceride (TG) levels and severity of stroke.

Materials and Method: This study was conducted at Government Medical College Amritsar in 50 stroke cases to correlate the triglyceride levels, in these patients, with stroke severity on the basis of Scandinavian Stroke Scale.

Results: It was concluded from the study that mean serum triglyceride levels were significantly lower in severe stroke patients [109.35± 36.43mg/dl] than mild to moderate stroke patients [154± 62.33mg/dl].

Conclusion: It was concluded that low levels of triglyceride adversely affected stroke severity in our subset of population. Global studies may be required to assess variations across populations.

Keywords: Ischemic stroke, Scandinavian stroke scale, Triglyceride.

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction:

As per the World Health Organization (WHO) stroke is defined as “a symptom complex of rapidly developing focal neurological deficit that lasts more than 24 hours, which is of vascular origin[1].”

Stroke entails a high socioeconomic burden due to increased morbidity and mortality and more commonly affects elderly patients who comprise a continuously increasing

proportion of the population in developed countries. Ischemic stroke (IS) accounts for about 80% of total stroke events. Various studies from India have reported an incidence varying from about 147 to 922/100,000 persons[2,3].

Earlier studies have suggested the role of elevated total cholesterol and low-density lipoprotein cholesterol (LDL-C) and low

levels of high-density lipoprotein cholesterol (HDL-C) in the pathogenesis of ischemic stroke[4,5,6]. Serum levels of HDL-C and triglycerides are inversely related to each other[7,8].

Little has been reported to date on the role of triglycerides in acute stroke. The purpose of our research was to study the correlation between serum triglyceride levels and severity of stroke.

Materials and Methods:

The present study was conducted in fifty stroke patients admitted in the Medicine Department, Guru Nanak Dev Hospital attached to Govt. Medical College, Amritsar after approval from the Institutional Ethics Committee. This was a co-relational study.

Inclusion Criteria:

Patients admitted with first ever ischemic stroke arriving within 24 hours of symptom onset, confirmed by imaging,

Exclusion Criteria:

- Patients admitted to the hospital > 24 hours after stroke onset.
- Previous history of stroke.
- Previous history of transient ischemic attack.
- Haemorrhagic stroke.
- Patients with space occupying lesions.
- Patients with cerebral venous/sinus thrombosis (CVT).

Method of collection of data:

Brain imaging Non-Contrast Computed Tomography (NCCT head) or Magnetic Resonance Imaging (MRI brain) was taken within 48 hours after stroke onset for all patients with first ever stroke admitted in our hospital. Stroke severity on admission was assessed using Scandinavian stroke scale (SSS). The patients were divided into 2 groups:

Group I: Those with severe stroke (SSS < 25)

Group II: Those with mild/moderate stroke (SSS > 25).

In addition to routine investigations as per standard protocol in the evaluation of stroke patient, fasting serum triglyceride and total cholesterol were measured between 12 and 48 hours after stroke onset.

Observations & Results:

The total number of patients included in present study was 50 with mean age of 62.3 years with an age range of 36 to 85 years. 54% of the patients were below 65 years and 46% of patients were above 65 years of age. 50% of patients were males and 50% were females. In the present study 80% of the patients had triglycerides ≤ 150 mg/dl and 20% of the patients had high level of triglycerides (> 150 mg/dl). 56% of the patients had severe stroke whereas 44% of the patients has mild to moderate stroke. Hypertension was present in 66% of the cases. Diabetes mellitus was present in 46% of the cases. Obesity was present in 8% of the cases.

Table 1: Association between triglycerides level and various parameters

Parameter		≤ 150	> 150	Total	P Value
Gender	Male	18	7	25	0.157
	Female	22	3	25	
	Total	40	10	50	
Age	< 65	19	8	27	0.065
	≥ 65	21	2	23	

	Total	40	10	50	
(SSS)	≤25	25	2	27	0.015
	>25	15	8	23	
	Total	40	10	50	
Hypertension	Yes	26	7	33	.765291
	No	14	3	17	
	Total	40	10	50	
Diabetes mellitus	Yes	17	6	23	0.32
	No	23	4	27	
	Total	40	10	50	
Obesity	Yes	4	0	4	0.571
	No	36	10	46	
	Total	40	10	50	

The total number of patients <65 years were 27 (54%) amongst which 19 (70%) had triglyceride level ≤150 mg/dl and 8 (30%) patients had triglyceride level >150 mg/dl.

The total number of patients in the age group ≥65 was 23 (46%) of which 21 (91.3%) had triglyceride level ≤150 mg/dl and 2 (8.6%) patients had triglyceride level >150 mg/dl. [chi square stat 3.40; p-value 0.065] Therefore no association between TG Level and age was found at 5% level of significance.

Of all the patients enrolled 25 (50%) were males and 25 (50%) were females. Among the males, 18 (72%) had triglyceride level ≤150 mg/dl and 7 (28%) had Triglyceride level >150 mg/dl. Amongst the females, 22 (88%) had triglyceride level ≤150 mg/dl and 3 (12%) had triglyceride level >150 mg/dl. [chi-square value 2; p-value 0.157]. There association between TG level and gender was statistically insignificant.

27 (54%) patients had severe stroke (SSS≤25) and 23 (46%) had mild to moderate stroke (SSS>25). Among severe stroke patients, 25 (86%) had triglyceride level ≤150 mg/dl and 4 (14%) had triglyceride level >150 mg/dl. Among mild to moderate stroke patients, 15 (71%) had triglyceride level ≤150 mg/dl and 6 (29%) had triglyceride level >150 mg/dl. Mean triglyceride level in severe stroke patients [SSS <25] was 109.35± 36.43 mg/dl (n=27); while that in mild to moderate stroke [SSS> 25] was 154± 62.33mg/dl. The two tailed p value test showed a statistically significant association between TG level and SSS. [table 2] The mean of TG levels in patients with severe stroke was significantly lower than that in patients with mild to moderate stroke.

Table 2: Two tailed p value test

	Severe Stroke	Mild to Moderate Stroke			
Scandinavian Stroke Score[SSS]	≤25	>25	p-value 0.0028, 95% CI -16.13 to 73.17	t	df
Number of patients [n]	27	23			
Triglyceride levels [mg/dl]	109.35 ± 36.43	154± 62.33		3.14	48

In the present study, 33 (66%) patients were found to be hypertensive, 23 (46%) were diabetic and four (8%) were obese but there was no statistically significant association with triglyceride of any of these

Discussion:

In the present study 80% of the patients had low level of triglycerides (≤ 150) and 20% of the patients had high level of triglycerides (>150). The findings of our study were similar to previous studies done by Dziedzic et al[9], Li et al[10], Jain et al[11] and Ryu et al[12] who showed that patients with low serum triglyceride levels on admission after acute stroke were associated with stroke severity and worse prognosis. Weir in his study of nondiabetic patients who presented with acute stroke stated that low triglyceride concentration strongly predicts higher mortality following stroke[13]. Outcome following stroke is related more strongly to triglyceride-rich than to cholesterol-rich lipoprotein concentrations.

Triglyceride levels are associated with nutrition status. The low triglyceride level is an indicator of malnutrition. Malnutrition after acute stroke is a poor prognostic factor[14,15]. In present study there was no statistically significant relationships between triglyceride and gender ($p = 0.1823$). Jain et al also reported no statistically significant relationships between triglycerides and gender[11].

The mean of TG levels in patients with severe stroke was statistically lower than that in patients with mild to moderate stroke. The findings of our study are in concordance with the study done by Dziedzic et al[9] and Li et al[10] who stated that lower level of triglyceride is associated with more severe stroke.

In contrast, a study performed by Simundic et al found that patients with a higher severity of stroke had higher serum triglycerides[16].

However, in our study, low triglyceride levels had poorer outcomes than patients with normal triglyceride levels. At a cellular level, extremely low levels would be harmful because lipids are essential for constituting the cell membrane and maintaining homeostasis. Moreover, an abnormally low triglyceride levels induces a poor nutritional and physical state which can have a detrimental effect on early outcomes. Therefore, it is plausible that an extremely low triglyceride levels could be harmful to patients with stroke, and so, triglyceride levels within low normal limits could lead to better early outcomes[17,18]. Lower triglyceride levels have been shown to correlate inversely to stroke infarct volumes on CT scan[19].

Karim in their study reported that ischemic stroke has significant association with a higher level of triglyceride, LDL and total cholesterol. However inverse relation was established with HDL[20]. Therefore hypercholesterolemia along with hypertriglyceridemia may be a risk factor for ischemic stroke. Wakabayashi in their study reported that the triglycerides are significantly higher in the hypertensive stroke patients[21].

In this study, mean serum triglyceride levels were significantly lower in patients with severe stroke when compared to the levels in patients with mild to moderate stroke. As per this study, obesity, hypertension, diabetes mellitus, age and sex of an individual did not influence levels of serum triglyceride levels.

Conclusion:

It was concluded that mean serum triglyceride levels were significantly lower in patients with severe stroke when compared to

the levels in patients with mild to moderate stroke. So, it was inferred that low levels of triglyceride may adversely affect stroke severity although there may be ethnic, racial, geographical and cultural variations. Studies on a global scale are required to propound a hypothesis.

References:

1. Warlow CP, van Gijn J, Dennis MS, Wardlaw JM, Bamford JM, Hankey GJ, Sandercock PA, Rinkel G, Langhorne P, Sudlow C, Rothwell P. Stroke: Practical Management. John Wiley & Sons; 2011.
2. Prasad K, Vibha D, Meenakshi. Cerebrovascular disease in South Asia - Part I: A burning problem. JRSMB Cardiovasc Dis. 2012 Oct 31;1(7):cvd.2012.012025.
3. Bharucha NE, Bharucha EP, Bharucha AE, Bhise AV, Schoenberg BS. Prevalence of stroke in the Parsi community of Bombay. Stroke. 1988 Jan;19(1):60-2.
4. Shi FL, Hart RG, Sherman DG, Tegeler CH. Stroke in the People's Republic of China. Stroke. 1989 Nov;20(11):1581-5.
5. Ariesen MJ, Claus SP, Rinkel GJ, Algra A. Risk factors for intracerebral hemorrhage in the general population: a systematic review. Stroke. 2003 Aug;34(8):2060-5.
6. Donnan GA, Hankey GJ, Davis SM. Intracerebral haemorrhage: a need for more data and new research directions. Lancet Neurol. 2010 Feb;9(2):133-4.
7. Wittrup HH, Tybjaerg-Hansen A, Nordestgaard BG. Lipoprotein lipase mutations, plasma lipids and lipoproteins, and risk of ischemic heart disease. A meta-analysis. Circulation. 1999 Jun 8;99(22):2901-7.
8. National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. Circulation. 2002 Dec 17;106(25):3143-421.
9. Dziedzic T, Slowik A, Gryz EA, Szczudlik A. Lower serum triglyceride level is associated with increased stroke severity. Stroke. 2004 Jun;35(6):e151-2.
10. Li W, Liu M, Wu B, Liu H, Wang LC, Tan S. Serum lipid levels and 3-month prognosis in Chinese patients with acute stroke. Adv Ther. 2008 Apr;25(4):329-41.
11. Jain M, Jain A, Yerragonduru N, Brown RD, Rabinstein A, Jahromi BS, Vaidyanathan L, Blyth B, Stead LG. The Triglyceride Paradox in Stroke Survivors: A Prospective Study. Neurosci J. 2013; 2013:870608.
12. Ryu WS, Lee SH, Kim CK, Kim BJ, Yoon BW. Effects of low serum triglyceride on stroke mortality: a prospective follow-up study. Atherosclerosis. 2010 Sep;212(1):299-304.
13. Weir CJ, Sattar N, Walters MR, Lees KR. Low triglyceride, not low cholesterol concentration, independently predicts poor outcome following acute stroke. Cerebrovasc Dis. 2003;16(1):76-82.
14. FOOD Trial Collaboration. Poor nutritional status on admission predicts poor outcomes after stroke: observational data from the FOOD trial. Stroke. 2003 Jun;34(6):1450-6.
15. Shen HC, Chen HF, Peng LN, Lin MH, Chen LK, Liang CK, Lo YK, Hwang SJ. Impact of nutritional status on long-term functional outcomes of post-acute stroke patients in Taiwan. Arch Gerontol Geriatr. 2011 Sep-Oct;53(2):e149-52.

16. Simundic AM, Nikolac N, Topic E, Basic-Kes V, Demarin V. Are serum lipids measured on stroke admission prognostic? *Clin Chem Lab Med.* 2008;46(8):1163-7.
17. Wang IK, Liu CH, Yen TH, Tsai IJ, Sung FC. Lower Fasting Serum Triglyceride Levels on Admission are Associated with Increased Risks of 30-Day and 1-Year Mortality in Patients with Ischemic Stroke. *Angiol.* 2018;6(212):2.
18. Choi KH, Park MS, Kim JT, Chang J, Nam TS, Choi SM, Lee SH, Kim BC, Kim MK, Cho KH. Serum triglyceride level is an important predictor of early prognosis in patients with acute ischemic stroke. *J Neurol Sci.* 2012 Aug 15;319(1-2):111-6.
19. Pikija S, Milevcic D, Trkulja V, Kidemet-Piskac S, Pavlicek I, Sokol N: Higher serum triglyceride level in patients with acute ischemic stroke is associated with lower infarct volume on CT brain scans. *Eur Neurol* 2006; 55:89–92.
20. Karim ME, Mondal SK, Kabir AH, Das PP, Biswas S, Ahmed NS. Association of Hypertriglyceridemia with Ischemic Stroke, Study in a Tertiary Care Hospital in Bangladesh. *Journal of Medicine.* 2016 Oct 23;17(1):21-6.
21. Wakabayashi I. Alcohol intake and triglycerides/high-density lipoprotein cholesterol ratio in men with hypertension. *American journal of hypertension.* 2013 Mar 21;26(7):888-95.