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Correlation between Acute Ischemic Stroke, Higher Total Cholesterol Level and High Barthel Index Score

Amna Siddique, Hassan Bukhari, Asim Shoukat, Zahid Mahmood, Nosheen Ahmad

Authors

1. Dr. Amna Siddique
Medical Office, Medicine
Allied Hospital, Faisalabad

2. Dr. Hassan Bukhari
Senior Registrar, Radiology
Allied Hospital, Faisalabad

3. Dr. Asim Shoukat
Associate Professor, Radiology
PMC / Allied Hospital, Faisalabad

4. Dr. Zahid Mahmood
Medical Officer, Medicine
Allied Hospital, Faisalabad

5. Dr. Nosheen Ahmad
Senior Registrar, Radiology
Allied Hospital, Faisalabad

Corresponding Author
Dr. Hassan Bukhari
Senior Registrar, Radiology
Allied Hospital, Faisalabad
Contact: +92 300-6652174
Email: hassanbukhari@gmail.com

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ABSTRACT

Objectives: To determine the correlation between higher total cholesterol level and high Barthel Index score in patients with acute ischemic stroke. **Methodology:** This cross sectional study was conducted at Radiology department and Medical Unit 1, Allied Hospital, Faisalabad for duration of 6 months from January 2015 to June 2015. 200 patients were included through Consecutive (non-probability) sampling technique. All the patients were undergone CT scan Brain from the radiology department of the Allied hospital to determine the respective changes (hypo dense area) of the ischemic stroke. Fasting serum cholesterol was measured in all patients after an overnight fast of 12 hours by drawing blood through 5cc BD syringe by me. Then all the patients were assessed by using Barthel Index score (BI). Higher total cholesterol and high BI score were labeled after assessing the laboratory and clinical findings. The data was analyzed by using SPSS version 17.0. Spearman Rank correlation coefficient was calculated to BI score in patients with ischemic stroke. P-value≤0.05 was considered as significant. **Results:** The mean age of the patients was noted as 61.76±11.55 years. In this study 55.50% were males and 44.50% patients were females. The mean total cholesterol value of patients was noted as 251.59±71.15 mg/dl. Out of 200 patients, 112 (56%) patients had high cholesterol (>200mg/dl) whereas 88 (44%) patient had low cholesterol of (<200mg/dl). In this study the results showed that the mean value of total Barthel index score was 57.50±19.52. The study results described that 103 (51.50%) patients had high Barthel index score (>53) whereas 97 (48.50%) patients had low Barthel index score (<53). Spearman correlation coefficient was calculated between high TC and high BI score as r= 0.631. This value was statistically significant i.e. p-value=0.000*. **Conclusion:** With the help of this study, we found a significant positive relationship between high TC and high BI score in patients presented with ischemic stroke. Now we can better prognosticate the functional outcome of ischemic stroke in our patients.

Keywords: Ischemic stroke, Barthel Index score, Total Cholesterol level, Spearman correlation, prognosis.

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INTRODUCTION

Among all deaths, 40-50% are due to vascular events of which 10% are due to stroke.[1] More than two-thirds of the global burden of stroke is borne by developing countries, especially Asia, where the average age of patients with stroke is 15 years younger than in developed countries.[2] According to Pakistan Stroke Society, the estimated stroke incidence in Pakistan is close to 250 per 100,000 population, which means that there are 350,000 new stroke patients every year in this country.[3] Ischemic stroke is the most common cause of stroke in Pakistan. In one study it was reported that 72% of the patients presenting in the hospital had ischemic stroke and 28% had hemorrhagic stroke.[4]

Relation of higher total cholesterol and triglycerides with ischemic heart disease is well established and high cholesterol levels are estimated to cause 56% of ischemic heart disease worldwide.[5] However, High serum cholesterol levels, as a risk factor for ischemic stroke, have been quite controversial in recent times. It has been observed in several studies that higher cholesterol and triglyceride levels are associated with better outcome after ischemic stroke.[6,7]

These observations have given rise to many questions regarding the known risk factors for ischemic stroke specially the derangement in lipid profile. In one of the studies, it was demonstrated that patients with acute ischemic stroke who had a higher serum cholesterol on admission, had a better Barthel Index score (r=0.211, p-value=0.029).[6] It was reported that Higher total cholesterol at the acute phase of ischemic stroke turned out to be a favorable prognostic factor for long-term motor functions.

Nearly 800,000 people suffer strokes each year in the United States; 82-92% of these strokes are ischemic. Stroke is the fourth leading cause of adult death and disability resulting in over $72 billion in annual cost. Ischemic and hemorrhagic strokes cannot be reliably differentiated on the basis of clinical examination findings alone. Further evaluation, especially with brain imaging tests (i.e., CT scanning or MRI), are required.[8]

The rationale of this study was to find a relationship of higher cholesterol levels with the recovery of acute ischemic stroke by assessing the clinical improvement of the patients, in terms of Barthel index score. This study did not only project a specific correlation of higher cholesterol level with higher Barthel scores, but also implies that this parameter may help us to determine the prognosis of an ischemic stroke.

METHODOLOGY

This was a Cross-sectional study undertaken in Department of Radiology & Medical Unit 1, Allied Hospital Faisalabad. After taking approval from the ethical committee, 200 patients who fulfilled selection criteria were enrolled in the study from emergency of the Medicine Department of the Allied hospital Faisalabad. Study was carried out over a period of six months from January 2015 to June 2015. Informed consent was obtained. All the 200 Consecutive patients of both gender, age of 25 years and more having signs and symptoms of acute ischemic stroke within previous 48 hours and diagnosed as having ischemic stroke (hypodense area) on CT scan brain. The patients excluded from the study are those with a history of a previous major stroke/ hemorrhagic stroke and patients with focal neurological deficit lasting less than 24 hour, to rule out transient Ischemic Attacks (TIA) and diabetic patients (BSR>180mg/dl), patients with medical record of MI or valvular heart disease and renal problem (Serum creatinine>1.2mg/dl

All the patients were undergone CT scan Brain by using 128 slice GE CT scanner from the Radiology department of the Allied hospital to determine the respective changes (hypodense area) of the ischemic stroke. Fasting serum cholesterol was measured in all patients after an overnight fast of 12 hours by drawing blood through 5cc BD syringe by me. Then we assessed the patients by using Barthel Index score (BI) (Annex A). Higher total cholesterol and high BI score were labelled after assessing the laboratory and clinical findings.

The data was analyzed by using SPSS version 17.0. Mean ± S.D was calculated for continuous variables including age, serum total cholesterol and BI score. Frequency and percentage were calculated for categorical variables i.e. gender, site of stroke, high cholesterol level. Spearman Rank correlation coefficient was calculated to measure the correlation between higher total cholesterol level and high BI score in patients with ischemic stroke. P-value<0.05 was considered as significant.

RESULTS

Total 200 patients were enrolled in this study. The mean age of the patients was noted as 61.76±11.55 years with minimum and maximum age values of 25 and 80 years respectively. Table#1

Table 1: Descriptive statistics about age (Years) of the patients

Age (Years)	**n**	200
	Mean	61.76
	SD	11.55
	Minimum	25
	Maximum	80

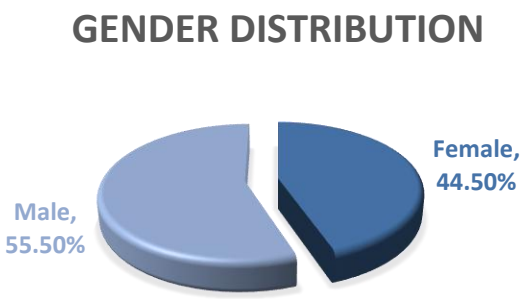


Fig 1: Distribution about gender of the patients

In this study 111 (55.5%) patients were males and 89 (44.5%) patients were females. The male to female ratio was 1.25:1. Fig#1

The mean total cholesterol value of patients was noted as 251.59±71.15 mg/dl with minimum and maximum values of 125 and 381 mg/dl respectively. Table#2

Table 2: Descriptive statistics about total cholesterol of the patients

Total cholesterol	**n**	200
	Mean	251.59
	SD	71.15
	Minimum	125
	Maximum	381

Out of 200 patients, 112 (56%) patients had high cholesterol level (>200mg/dl) whereas 88 (44%) patients had low cholesterol level (≤200mg/dl). Table#3

Table 3: Frequency distribution about high total cholesterol of the patients

		Frequency	**Percent**
Total Cholesterol	**>200mg/dl**	112	56.0
	<200mg/dl	88	44.0
	Total	**200**	**100.0**

In this study the results showed that the mean value of total Barthel index score was 57.50±19.52 with minimum and maximum values of 125 and 381 respectively. Table#4

Table 4: Frequency distribution about barthel score of the patients

Barthel Index score	**n**	200
	Mean	57.50
	SD	19.52
	Minimum	25
	Maximum	100

The study results described that 103 (51.50%) patients had high Barthel index score (>53) whereas 97 (48.50%) patients had low Barthel index score (<53). Fig#2

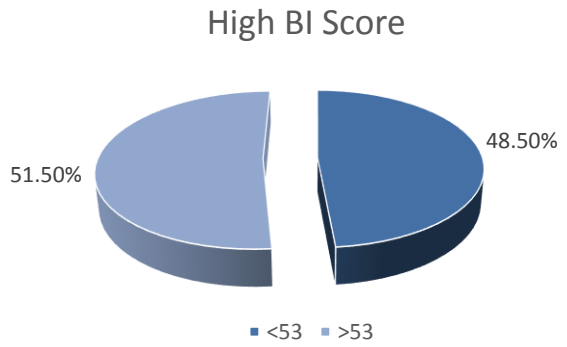


Fig 2: Distribution about high barthel index score of the patients

The study results showed that total 111 patients who had high TC, 89 were from high BI score and 22 were from low BI score. Similarly 89 patients who had low TC level, 14 had high BI score and 75 had low BI score. Spearman correlation coefficient was calculated between high TC and high BI score as r= 0.631. This value was statistically significant i.e. p-value = 0.000*. Table#5

Table 5: Comparison of high TC with high BI score of the patients

		Barthel Index score		**Total**
		>53	**<53**	
TC	**>200mg/dl**	89 (86.4%)	23 (22.7%)	112 (56%)
	<200mg/dl	14 (13.6%)	74 (77.3%)	88 (44%)
Total		**103** (100%)	**97** (100%)	**200** (100%)

Spearman correlation coefficient = r=0.631
p-value=0.000*

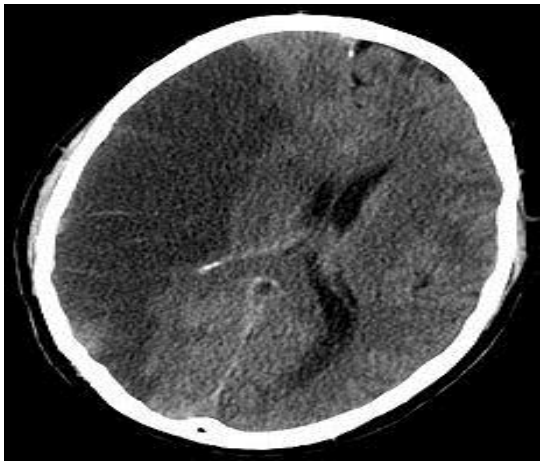


Figure III: CT scan slice of the brain showing a right-hemispheric ischemic stroke

DISCUSSION

At the beginning of 21st century and emerging of new era, cerebrovascular disease is a major cause of death and disability worldwide. Stroke is defined as the rapidly developing symptoms and / or signs of focal loss of cerebral function with no apparent cause other than that of vascular origin.[9]

The present study was carried out on 200 ischemic stroke patients of high cholesterol level, admitted in Allied hospital medical unit-1 Faisalabad, with an aim to determine the correlation between higher total cholesterol level and high Barthel Index score in patients with acute ischemic stroke. In our study the male were exposed in more number as compared to females.

Our study showed that 55.50% were males and 44.50% were females. Similar results were also seen in the stroke study done in Nepal by Naik, et al in which, total of 150 stroke patients studied , out of whom 104 males and 46 females with male: female 2.3:1 was observed.[10]

Mumtaz AM, et al in Pakistan, also in their study showed that out of 88 stroke patients, 62 (70.5%) were males and 26 (29.5%) were females.[11]

Study done in Nepal by Krishna CD, et al where they found the mean age was 61.65 ±14.9 years, ranging from 20 to 100 years.[12] The findings were similar to my study in which the mean age of the patients was noted as 61.76±11.55 years with minimum and maximum age values of 25 and 80 years respectively. Mean age was higher in other studies; mean age 70.2 ± 10.8 years in study done by Efstathiou SP, et al., and similarly in the study done by Smadja D, et al mean age was 71.2±14 years.[13,14]

Kate Tilling, et al showed results about BI. They concluded that the 299 subjects, 30 of whom died before the end of the study, were assessed on a total of 1346 occasions. The mean BI at each occasion for all patients and for those who were and were not assessed at every occasion. Mean BI increased initially and then decreased slightly between 4 months and 1 year. The average pattern of recovery was an initial increase in BI, then a longer-term plateau and then a decline.[15] Whereas my study results showed the mean value of BI as 57.50±19.52 with range of 25 and 100.

Another study done by Vincent N ,et al showed that 39 patients (62%) had a Barthel Index score ≥85 and 24 (38%) had a Barthel Index score <85. The median Barthel Index score was 25 (interquartile range, 5 to 65) in the group with Barthel <85 and was 100 (25th percentile, 95) in the independent outcome group. This study also showed that the correlation value of −0.504 found between the ischemic lesion volume on DWI and the final Barthel Index score indicated some (albeit weak) linkage between the volume of the early DWI and the clinical outcome. The weak correlation can likely be attributed to both the numerous additional factors that influence functional outcome and the relative inadequacy of functional outcome scales.[16]

An association between high serum cholesterol levels and reduced mortality after ischemic stroke has been described. Patients with high cholesterol levels (N250 mg/dL) had a 2.2-fold lower risk of death and a 2.1-fold lower risk of a poor functional outcome at 1 month.[17] Low cholesterol and triglyceride levels were also found to be strong independent predictors of in-hospital mortality after intracerebral hemorrhage.[18]

Cholesterol may act as a buffer by neutralizing a proportion of the free radicals and thereby increasing the cellular recuperation capacity.[19,20]

Stachon and colleagues reported that cholesterol levels decreased sharply immediately after surgery in both survivors and non-survivors.[21] In a study among critically ill surgical patients, post-operative serum cholesterol levels below 40 to 80 mg/dL were associated with a 2- to 3.5-fold increased risk of death compared with normal cholesterol levels.[22]

Similarly, a study of 2909 trauma patients reported that a serum level of cholesterol below 50 to 60 mg/dL was significantly related to an increased mortality rate (OR 2.0–5.1).[23] Messoten and colleagues found that extremely low levels of HDL-(<15 mg/dL) and LDL-cholesterol (<20 mg/dL) were both related to a 3- to 4-fold increased rate of mortality among ICU patients. In addition, patients with high serum level of triglycerides (>300 mg/dL) had higher mortality rates than patients with low levels of triglycerides (<1100 mg/dL) (37% vs. 7%). A higher predictive value for serum cholesterol was reported in a study using serial measurements of lipids.[24]

Our study results also showed the significance and positive correlation between the BI score and HTC of ischemic stroke patients (r=0.631, p=0.000). Pan SL, et al., concluded in their study that correlation across repeated measurement of BI scores, the TC level, baseline BI, follow-up time and infarct size were identified as significant predictors for serial BI

scores. Higher TC levels correlated with better functional outcomes. This study demonstrated that patients with acute ischemic stroke who had a higher serum cholesterol on admission, had a better Barthel Index score (r=0.211, p-value=0.029).(6)

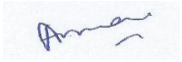
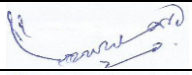
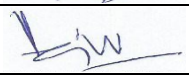
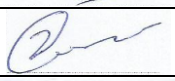
CONCLUSION

With the help of this study, we found a significant positive relationship between high TC and high BI score in patients presented with ischemic stroke. Now we can better prognosticate the functional outcome of ischemic stroke in our patients.

REFERENCES

1. Nagaraj SK, Pai P, Bhat G, Hemalatha A. Lipoprotein (a) and other lipid profile in patients with thrombotic stroke: Is it a reliable marker? Journal of laboratory physicians. 2011;3(1):28.
2. Mishra NK, Khadilkar SV. Stroke program for India. Annals of Indian Academy of Neurology. 2010;13(1):28.
3. Khealani BA, Hameed B, Mapari UU. Stroke in Pakistan. Journal of the Pakistan Medical Association. 2008;58(7):400.
4. Shah N, Ataullah S. Frequency of cerebral infarction and haemorrhage in the patients of stroke. Journal of Ayub Medical College, Abbottabad: JAMC. 2009;21(4):102.
5. Jeenger J, Sharma D, Sushil C, Vijayvergiya D, Sanadhya R. Relationship of personality characteristics and stressful life events to Myocardial Infarction: A case control study. Journal of Mental Health and Human Behaviour. 2013;1:45.
6. Pan S-L, Lien I, Chen TH-H. Is higher serum total cholesterol level associated with better long-term functional outcomes after noncardioembolic ischemic stroke? Archives of physical medicine and rehabilitation. 2010;91(6):913-8.
7. Li W, Liu M, Wu B, Liu H, Wang L-C, Tan S. Serum lipid levels and 3-month prognosis in Chinese patients with acute stroke. Advances in therapy. 2008;25(4):329-41.
8. Taylor AA, Ragbir S. Three in one: safety, efficacy, and patient acceptability of triple fixed-dose combination medicine in the management of hypertension. Patient prefer adherence. 2012;6:555.
9. Shyu W-C, Lin S-Z, Lee C-C, Liu DD, Li H. Granulocyte colony-stimulating factor for acute ischemic stroke: a randomized controlled trial. Can Med Assoc J. 2006;174(7):927-33.
10. Bhalla D, Marin B, Preux PM. Stroke profile in Afghanistan and Nepal. Neurol Asia. 2009;14:87-94.
11. Mumtaz AM, Muhammad U, Muhammad H. Stroke and its relationship to risk factors. GJMS. 2009;7(1):169-75.
12. Krishna CD, Suman BT, Sharmila M. Retrospective analysis of stork and its risk factors at Nepal Medical College Teaching Hospital. NMCJ. 2006.
13. Efstathiou S, Tsioulos D, Zacharos I, Tsiakou A, Mitromaras A, Mastorantonakis S, et al. A new classification tool for clinical differentiation between haemorrhagic and ischaemic stroke. Journal of internal medicine. 2002;252(2):121-9.
14. Olindo S, Cabre P, Deschamps R, Chatot-Henry C, Rene-Corail P, Fournerie P, et al. Acute Stroke in the Very Elderly Epidemiological Features, Stroke Subtypes, Management, and Outcome in Martinique, French West Indies. Stroke. 2003;34(7):1593-7.
15. Tilling K, Sterne JA, Rudd AG, Glass TA, Wityk RJ, Wolfe CD. A new method for predicting recovery after stroke. Stroke. 2001;32(12):2867-73.
16. Thijs VN, Lansberg MG, Beaulieu C, Marks MP, Moseley ME, Albers GW. Is early ischemic lesion volume on diffusion-weighted imaging an independent predictor of stroke outcome? A multivariable analysis. Stroke. 2000;31(11):2597-602.
17. Vauthey C, De Freitas G, Van Melle G, Devuyst G, Bogousslavsky J. Better outcome after stroke with higher serum cholesterol levels. Neurology. 2000;54(10):1944-9.
18. Jimenez-Conde J, Biffi A, Rahman R, Kanakis A, Butler C, Sonni S, et al. Hyperlipidemia and reduced white matter hyperintensity volume in patients with ischemic stroke. Stroke. 2010;41(3):437-42.
19. Joseph J, Villalobos-Molinas R, Denisova N, Erat S, Strain J. Cholesterol: a two-edged sword in brain aging. Free Radical Biology and Medicine. 1997;22(3):455-62.
20. Tramer F, Rocco F, Micali F, Sandri G, Panfili E. Antioxidant systems in rat epididymal spermatozoa. Biology of reproduction. 1998;59(4):753-8.
21. Stachon A, Böning A, Weisser H, Laczkovics A, Skipka G, Krieg M. Prognostic significance of low serum cholesterol after cardiothoracic surgery. Clinical chemistry. 2000;46(8):1114-20.
22. Gui D, Spada P, De Gaetano A, Pacelli F. Hypocholesterolemia and risk of death in the critically ill surgical patient. J Intensive Care Med. 1996;22(8):790-4.
23. Elliott DC, Wiles CE. Low lipid concentrations in critical illness: hypocholesterolemia among trauma patients. Crit Care Med J. 1997;25(8):1437-9.
24. Mesotten D, Swinnen JV, Vanderhoydonc F, Wouters PJ, Van den Berghe G. Contribution of circulating lipids to the improved outcome of critical illness by glycemic control with intensive insulin therapy. J. Clin. Endocrinol. Metab. 2004;89(1):219-26.

AUTHORSHIP AND CONTRIBUTION DECLARATION

Name of Author	Contribution to the paper	Author's Signatures
Dr. Amna Siddique	Statistical Analysis	
Dr. Hassan Bukhari	Main Author	
Dr. Asim Shoukat	Research Supervisor	
Dr. Zahid Mahmood	Co-Author	
Dr. Nosheen Ahmad	Co-Author