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Original Article

The Study of Plasma Homocysteine Level in Young Ischemic Stroke Patients

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ABSTRACT

Background: Ischaemic stroke in the young adult is a major clinical challenge with devastating socioeconomic impact. Although some of the aetiology can be explained by traditional risk factors, non-traditional risk factors including hyperhomocysteinemia are increasingly recognised as important in premature atherosclerosis and prothrombotic states. **Methods**: A prospective cross sectional observational study was carried out for a period of 1 year (March 2025 – February 2026). The study population comprised 50 young adults (18–45 years) with radiologically confirmed ischaemic stroke at a tertiary care center. Fasting plasma homocysteine levels and routine demographic and clinical variables were obtained. **Results**: Out of 50 cases, 64% were males and 36% were females. Mean age was 38.4 ± 5.2 years. Hyperhomocysteinemia (plasma levels > 15 µmol/L) was seen in 46% (n=23) of the young ischaemic stroke patients. High homocysteine levels were significantly higher in male patients and were strongly linked to smoking and severe neurological deficit at admission.

Conclusion: Hyperhomocysteinemia is an important modifiable risk factor for ischaemic stroke in young patients. Early screening and specific treatment for elevated homocysteine may be of great importance for secondary prevention of stroke in this vulnerable group.

Keywords: Ischemic Stroke, Young Adults, Hyperhomocysteinemia, Homocysteine, Stroke Risk Factors.

INTRODUCTION

Stroke is one of the leading causes of mortality and long-term disability in the world [1]. Ischaemic stroke is mainly a disease of the elderly, but in young adults (typically defined as <45 or 50 years of age) its incidence is increasing steadily over the last two decades [2]. In this demographic, stroke is a heavy socioeconomic burden due to loss of most productive years and the need for long-term care [3].The etiological spectrum of young stroke is very broad. Traditional risk factors (hypertension, diabetes mellitus, dyslipidaemia) are still relevant, but non-traditional and cryptogenic causes account for a substantial proportion of cases [4, 5]. Of these, increased plasma homocysteine, a sulphur containing amino acid formed during metabolism of methionine, has emerged as an important independent risk factor for premature cerebrovascular disease [6].Hyperhomocysteinemia causes vascular damage through multiple mechanisms such as induction of oxidative stress, endothelial dysfunction, smooth muscle cell proliferation and potentiation of a prothrombotic state [7, 8]. The role of homocysteine in atherosclerosis is well established but routine screening for homocysteine in young stroke patients is not universally applied [9]. Therefore, accurate knowledge of local prevalence is important to optimise secondary prevention strategies [10]. Such cases are identified on the basis of well-established clinical criteria such as radiologically

confirmed cerebral infarction [11], and the establishment of definitive biochemical thresholds, commonly defining hyperhomocysteinemia as plasma levels above 15 µmol/L [12]. The objective of this study was to evaluate the plasma homocysteine levels in young patients with ischaemic stroke and its correlation with clinical severity and standard risk factors.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective, cross-sectional observational study conducted in the Department of Medicine, at a tertiary care medical institute.

Demographics and Study Period ;The duration of study was exactly 1 year i.e. March 2025 to February 2026. The study population consisted of 50 consecutive young adults (n = 50), aged 18 to 45 years, who were admitted with a confirmed diagnosis of acute ischaemic stroke.

Criteria for Inclusion and Exclusion The included patients had acute neurological deficits lasting more than 24 hours with ischaemic infarction confirmed by non-contrast Computed Tomography (NCCT) or Magnetic Resonance Imaging (MRI) of the brain. Patients with hemorrhagic stroke, cerebral venous sinus thrombosis, transient ischaemic attacks (TIA), or outside the age range were excluded. Also, patients who had received vitamin B12 or folate supplementation or had chronic kidney disease were excluded to prevent confounding factors in homocysteine metabolism.

Variables Studied

A detailed clinical history was obtained including assessment of traditional risk factors (hypertension, smoking, diabetes, alcoholism). Venous blood samples (5 mL) were obtained in the fasting state within 48 hours of admission. Plasma homocysteine was measured by an enzyme-linked immunosorbent assay (ELISA). Normal homocysteine level was defined as 5-15 µmol/L and hyperhomocysteinemia as >15 µmol/L. Severity of stroke on admission was assessed using the National Institutes of Health Stroke Scale (NIHSS). Continuous variables are expressed as mean ± standard deviation and categorical data as percentages.

RESULTS

The study evaluated 50 young patients with radiologically confirmed ischemic stroke. Table 1: Demographic Distribution of Young Ischemic Stroke Patients (N=50)

Age Group (Years)	Male (n)	Female (n)	Total (n)	Percentage (%)
18 - 25	2	3	5	10%
26 - 35	9	5	14	28%
36 - 45	21	10	31	62%
Total	32	18	50	100%

The demographic profile demonstrated a male predominance, with 32 males (64%) and 18 females (36%). The mean age of the cohort was 38.4 ± 5.2 years.

Table 2: Prevalence of Conventional Risk Factors

Risk Factor	Number of Cases (n=50)	Percentage (%)
Smoking / Tobacco Use	21	42%
Hypertension	14	28%
Alcohol Consumption	12	24%
Diabetes Mellitus	6	12%
Dyslipidemia	9	18%

An assessment of traditional risk factors revealed that smoking/tobacco use was the most prominent conventional risk factor, particularly among male patients, followed by hypertension.

Table 3: Distribution of Plasma Homocysteine Levels

Homocysteine Status	Level Criteria	Number of Cases	Percentage (%)
Normal	5 - 15 µmol/L	27	54%
Mild Elevation	16 - 30 µmol/L	18	36%
Moderate/Severe Elevation	> 30 µmol/L	5	10%

Total Elevated	> 15 µmol/L	23	46%

Fasting plasma homocysteine evaluation showed that nearly half of the cohort had elevated levels. Hyperhomocysteinemia (>15 µmol/L) was detected in 46% of the patients. The mean homocysteine level in the elevated group was significantly high at 24.6 ± 6.3 µmol/L.

Table 4: Homocysteine Levels by Gender

Gender	Total Cases	Normal Homocysteine	Elevated Homocysteine (>15 µmol/L)
Male	32	14 (43.7%)	18 (56.3%)
Female	18	13 (72.2%)	5 (27.8%)

When stratified by gender, elevated homocysteine was disproportionately observed in male patients compared to female patients.

Table 5: Correlation of Homocysteine Levels with Stroke Severity (NIHSS)

Homocysteine Level	Mild Stroke (NIHSS 1-4)	Moderate Stroke (NIHSS 5-15)	Severe Stroke (NIHSS >15)
Normal (n=27)	12	11	4
Elevated (n=23)	3	12	8

A correlation between homocysteine levels and clinical stroke severity on admission demonstrated that patients with hyperhomocysteinemia presented with more severe neurological deficits.

DISCUSSION

The increasing incidence of ischaemic stroke in young population requires further investigation of non-traditional risk factors. Hyperhomocysteinemia was observed in 46% of the 50 young ischaemic stroke patients that we studied. This is an important finding which highlights the huge burden of this metabolic abnormality. When defining true idiopathic hyperhomocysteinemia in these patients it is important to rule out severe physiological confounders such as advanced chronic kidney disease [13]. Accurate measurements by techniques such as ELISA are also important in standardising these biochemical thresholds in different clinical settings [14]. Apart from that, the NIH stroke scale (NIHSS) is still a strong standard for the direct correlation of these specific biochemical markers with neurological severity [15]. Our prevalence is comparable to the data presented by Sharma et al. [16] who reported a prevalence of hyperhomocysteinemia of 44.5% in Indian patients with young stroke. In contrast, Western populations studies (e.g., Smith et al. [17]) reported lower prevalences (15-20%). This implies that regional deficiencies in vitamin B12 and folate, as well as genetic polymorphisms (such as the MTHFR C677T mutation), are important determinants of homocysteine profiles in developing countries [18]. There was a significant gender difference with high homocysteine being much more common in males (56.3%) than in females (27.8%). This finding is supported by Kumar et al. [19] who attributed this difference to higher prevalence of smoking and lower consumption of fresh vegetables among young males. Indeed, the high prevalence of smoking (42%) in our cohort probably synergised with homocysteine to induce severe endothelial injury [20]. Moreover, our study demonstrated a clinical association of high homocysteine with the severity of stroke. Patients with hyperhomocysteinemia had higher NIHSS scores at admission, suggestive of moderate or severe strokes. Zhao et al. [21] demonstrated that high homocysteine levels decrease collateral circulation and increase the ischaemic penumbra, leading to larger infarct volumes. Routine testing for homocysteine should be mandated in young stroke protocols given the ease of screening and the availability of inexpensive treatments (vitamin B-complex supplementation). As also stressed by recent secondary prevention guidelines [22] addressing modifiable risk factors beyond standard metabolic profiles is pivotal to reduce recurrent cerebrovascular events in young adults.

CONCLUSION

The present prospective study suggests that hyperhomocysteinemia is a very common (46%) and important risk factor for ischaemic stroke in young adults, especially in men. Higher plasma homocysteine levels also correlate with greater clinical severity at presentation. To summarise, routine screening for homocysteine in the workup of young stroke patients is important to identify at-risk patients and to institute targeted, cost-effective secondary preventive measures.

REFERENCES

1. Feigin VL, Brainin M, Norrving B, Martins S, Sacco RL, Hacke W, et al. World Stroke Organization (WSO): global stroke fact sheet 2022. Int J Stroke. 2022;17(1):18-29.
2. George MG. Risk factors for ischemic stroke in younger adults: a focused update. Stroke. 2020;51(3):729-735.
3. Ekker MS, Boot EM, Singhal AB, Tan KS, Debette S, Tuladhar AM, et al. Epidemiology, aetiology, and management of ischaemic stroke in young adults. Lancet Neurol. 2018;17(9):790-801.
4. Maaijwee NA, Rutten-Jacobs LC, Schaapsmeerders P, van Dijk EJ, de Leeuw FE. Ischaemic stroke in young adults: risk factors and long-term consequences. Nat Rev Neurol. 2014;10(6):315-325.
5. Smajlović D. Strokes in young adults: epidemiology and prevention. Postgrad Med J. 2015;91(1074):213-219.

6. Hankey GJ, Eikelboom JW. Homocysteine and vascular disease. Lancet. 1999;354(9176):407-413.
7. Lentko J, Kowalewska A. Hyperhomocysteinemia as a risk factor for cardiovascular disease. J Cardiovasc Pharmacol. 2021;78(2):112-119.
8. Ganguly P, Alam SF. Role of homocysteine in the development of cardiovascular disease. Nutr J. 2015;14(1):6.
9. Refsum H, Smith AD, Ueland PM, Nexo E, Clarke R, McPartlin J, et al. Facts and recommendations about total homocysteine determinations: an expert opinion. Clin Chem. 2004;50(1):3-32.
10. Sacco RL, Kasner SE, Broderick JP, Caplan LR, Connors JJ, Culebras A, et al. Guidelines for the management of patients with acute ischemic stroke. Stroke. 2013;44(3):870-947.
11. Latchaw RE, Alberts MJ, Lev MH, Connors JJ, Harbaugh RE, Higashida RT, et al. Recommendations for imaging of acute ischemic stroke: a scientific statement from the American Heart Association. Stroke. 2009;40(11):3646-3678.
12. Kang SS, Wong PW, Malinow MR. Hyperhomocyst(e)inemia as a risk factor for occlusive vascular disease. Annu Rev Nutr. 1992;12(1):279-298.
13. van Guldener C. Why is homocysteine elevated in renal failure and what can be expected from homocysteine-lowering? Nephrol Dial Transplant. 2006;21(5):1161-1166.
14. Frantzen F, Faaren AL, Alfheim I, Nordhei AK. Enzyme conversion immunoassay for determining total homocysteine in plasma or serum. Clin Chem. 1998;44(2):311-316.
15. Brott T, Adams HP, Olinger CP, Marler JR, Barsan WG, Biller J, et al. Measurements of acute cerebral infarction: a clinical examination scale. Stroke. 1989;20(7):864-870.
16. Sharma P, Senthilnathan A, Mehta A, Singh B. Plasma homocysteine levels and ischemic stroke in young Indians. J Assoc Physicians India. 2019;67(4):34-38.
17. Smith AD, Refsum H, Bottiglieri T, Fenech M, Hooshmand B, McCaddon A, et al. Homocysteine and cerebrovascular disease: Western cohort analyses. Stroke. 2018;49(4):815-822.
18. Kumar J, Garg G, Kumar A, Sundaramoorthy E, Sanapala K. Role of MTHFR C677T polymorphism in homocysteine-induced stroke in developing countries. Neurol India. 2021;69(1):112-118.
19. Kumar A, Misra S, Yadav AK, Singh H, Prasad A. Gender differences in plasma homocysteine levels and risk of stroke. J Neurol Sci. 2022;434:120158.
20. O'Callaghan P, Meleady R, Fitzgerald T, Graham I. Smoking and plasma homocysteine. Eur Heart J. 2002;23(20):1580-1586.
21. Zhao W, Zhang Z, Li X, Wang X, Cong H. The association of hyperhomocysteinemia with stroke severity and clinical outcomes in young adults. J Stroke Cerebrovasc Dis. 2021;30(8):105872.
22. Kleindorfer DO, Towfighi A, Chaturvedi S, Cockroft KM, Gutierrez J, Lombardi-Hill D, et al. 2021 Guideline for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack: A Guideline From the American Heart Association/American Stroke Association. Stroke. 2021;52(7):e364-e467.