



SERUM URIC ACID AS AN INDEPENDENT RISK FACTOR IN ACUTE ISCHEMIC STROKE: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Stroke is a leading cause of mortality and disability worldwide, with ischemic stroke accounting for the majority of cases. Serum uric acid (SUA), a product of Purine metabolism, has been implicated in cardiovascular and cerebrovascular diseases. However, its role as an independent risk factor remains controversial.

Objectives: To assess the relationship between serum uric acid and other risk factors such as hypertension, diabetes mellitus, and coronary artery disease with acute ischemic stroke.

Methods: A hospital-based cross-sectional study was conducted on 97 patients presenting with first-ever acute ischemic stroke. Serum uric acid levels were measured within 24 hours of admission. Clinical and biochemical parameters were analyzed. Statistical associations were evaluated using chi-square test and correlation analysis.

Results: Elevated serum uric acid levels were observed in a significant proportion of patients with acute ischemic stroke. Hyperuricemia showed a statistically significant association with hypertension and diabetes mellitus ($p < 0.05$). Patients with higher SUA levels had increased stroke severity and associated comorbidities.

Conclusion: Serum uric acid may serve as an independent risk factor for acute ischemic stroke and is strongly associated with traditional cardiovascular risk factors.

Keywords: Acute Ischemic Stroke, Serum Uric Acid, Hyperuricemia, Risk Factors.

INTRODUCTION

Stroke is defined as a sudden onset of neurological deficit due to a vascular cause. Ischemic stroke accounts for more than 80% of all stroke cases. Early identification of modifiable risk factors is crucial for prevention. Several well-established risk factors for ischemic stroke include hypertension, diabetes mellitus, dyslipidemia, smoking, and sedentary lifestyle. Among these, hypertension remains the most significant modifiable risk factor, contributing substantially to both incidence and recurrence of stroke [1]. The role of uric acid in vascular pathology is complex and somewhat paradoxical.

On one hand, it acts as a potent antioxidant, scavenging free radicals and potentially exerting neuroprotective effects during acute ischemic events. On the other hand, elevated levels of SUA (hyperuricemia) have been implicated in endothelial dysfunction, oxidative stress, inflammation, and activation of the renin-angiotensin system, all of which contribute to atherosclerosis and vascular injury [2]. Epidemiological studies have provided conflicting evidence regarding the role of SUA in ischemic stroke. Some studies suggest that elevated SUA is an independent risk factor for stroke and is associated with increased severity and poor outcomes [3]. Conversely, another study indicates a protective role of uric acid due to its antioxidant properties, thereby highlighting the ongoing controversy surrounding its exact role in stroke pathophysiology [4]. Furthermore, SUA has been shown to be closely associated with traditional cardiovascular risk factors such as hypertension, metabolic syndrome, and insulin resistance. A study done by Chamorro Á et al. demonstrated a significant association between elevated uric acid levels and increased risk of cardiovascular events,



www.ajmrhs.com
eISSN: 2583-7761

Date of Received: 22-02-2026
Date Acceptance: 23-03-2026
Date of Publication: 31-03-2026

including stroke [5]. Given these conflicting findings, there is a need for further studies to clarify whether serum uric acid acts as an independent risk factor or merely reflects the presence of other underlying comorbidities [6]. Understanding this relationship is particularly important in the context of developing countries, where the burden of stroke is high and early identification of modifiable risk factors can significantly impact prevention strategies.

Therefore, the present study was undertaken to evaluate the association between serum uric acid levels and acute ischemic stroke and to determine its relationship with established risk factors such as hypertension and diabetes mellitus.

MATERIALS AND METHODS

This cross-sectional observational study conducted in the department of the general medicine at Shri BM Patil Medical College and Hospital, Vijayapura, Karnataka from January 2020 – June 2020 (Six month duration).

A total of 97 patients’ of acute ischaemic stroke attending the OPD and IPD during study period were enrolled in this study.

Sample size was calculated by using the Cochran formula:

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where, z= critical value (95% confidence level), d is margin of error & p is anticipated incidence rate

Inclusion Criteria

- First-ever acute ischemic stroke
- Presentation within 24 hours
- Confirmed clinically ± CT/MRI
- Patients provide written informed consent for the study

Exclusion Criteria

- Previous stroke/TIA
- Drugs affecting uric acid (diuretics, allopurinol, etc.)
- Renal failure, gout
- Patients not willing to participate in the study

Data Collection: Informed consent form was obtained from all patients after explaining the study details. Demographic data, history, clinical examination and details of investigations were recorded in the study proforma. The blood samples were taken within 24 hrs of onset of stroke and sent for biochemical analysis and were analyzed. Detailed clinical history and various risk factors were assessed.

Laboratory investigations like complete hemogram, Serum uric acid, Blood glucose, Lipid profile and renal function test were done. Other investigation like ECG, 2D Echo, CT & MRI were also performed in each patient

Statistical Analysis: All statistical analyses were performed using IBM SPSS Statistics version 25.0. Continuous variables (e.g., serum uric acid, age) were expressed as mean ± standard deviation (SD). Categorical variables (e.g., gender, presence of hypertension, diabetes mellitus) were expressed as frequency and percentage. Chi-square test was used as test of significance. P value of <0.05 was considered as statistically significant

RESULTS

A total of 97 patients with first-ever acute ischemic stroke were included in the study

The majority of patients belonged to the older age group, with 62 (63.9%) patients aged ≥65 years, followed by 32 (32.9%) patients in the 45–64 years age group, and only 3 (3.1%) patients aged between 25–44 years. There was a male predominance, with 64 (66%) males and 33 (34%) females. Among comorbid conditions, hypertension was the most common, present in 52 (53.6%) patients, followed by diabetes mellitus in 28 (28.9%) patients. Other comorbidities such as COPD, hypothyroidism, Parkinson’s disease, and seizure disorder were observed in very few patients (≤2.1%). Regarding lifestyle habits, smoking was observed in 25 (25.8%) patients, alcohol consumption in 14 (14.4%), and tobacco use in 12 (12.4%) patients

Table 1: Demographic Features and Risk Factors among Study Participants

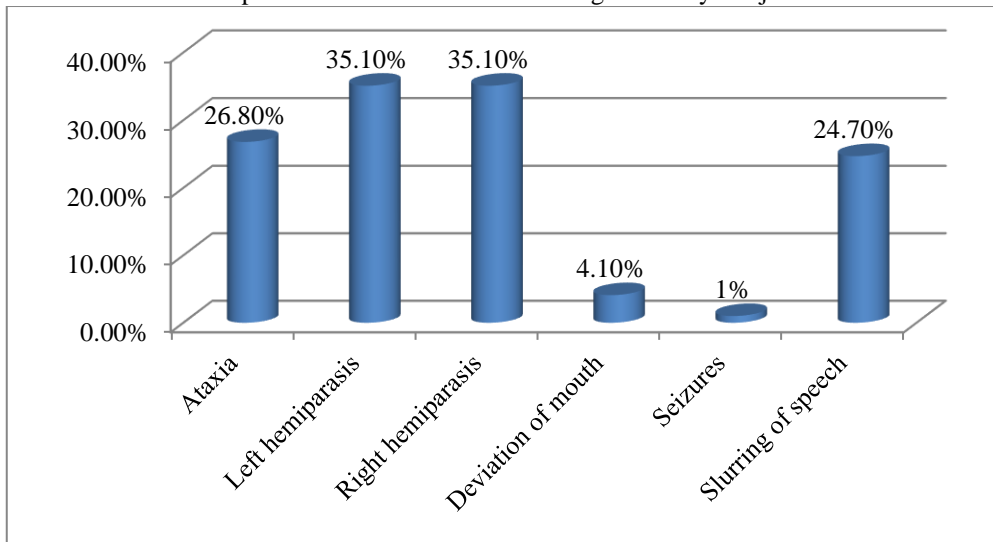
Demographic/Risk Factors		Frequency	Percentages
Age in years	25-44	3	3.1%
	45-64	32	32.9%
	≥65	62	63.9%
Gender	Male	64	66%
	Female	33	34%
Comorbidities	Hypertension	52	53.6%
	Diabetes mellitus	28	28.9%
	COPD	2	2.1%
	Hypothyroid	1	1%
	Parkinson’s	1	1%
	Seizure disorder	1	1%
Habits	Alcohol	14	14.4%

	Smoking	25	25.8%
	Tobacco	12	12.4%

The most common clinical presentations included hemiparesis (both right and left-sided), followed by slurring of speech, deviation of the mouth, ataxia,

and seizures. Hemiparesis was the predominant neurological deficit observed among study participants.

Graph 1: Clinical Presentation among the Study Subjects



A statistically significant association was observed between elevated serum uric acid levels (≥ 6.5 mg/dL) and hypertension ($p = 0.005$). Among hypertensive patients, 50% had elevated uric acid

levels compared to only 22.2% among non-hypertensive patients. This indicates a strong relationship between hyperuricemia and hypertension in acute ischemic stroke patients.

Table 2: Association of Serum Uric Acid Level (Mg/Dl) with Hypertension in Study Patients

		HTN		P-Value
		Absent	Present	
uric acid level(mg/dl)	≥ 6.5	Count	10	0.005
		% within htn	22.2%	
	< 6.5	Count	35	
		% within htn	77.8%	
Total		Count	45	
		% within htn	100.0%	

No statistically significant association was found between serum uric acid levels and gender ($p = 0.437$). Elevated uric acid levels were observed in

42.4% of females and 34.4% of males, indicating no meaningful gender-based difference.

Table 3: Association of Serum Uric Acid Level (Mg/Dl) with Gender in Study Patients

		Gender		P-Value
		Female	Male	
uric acid level(mg/dl)	≥ 6.5	Count	14	0.437
		% within sex	42.4%	
	< 6.5	Count	19	
		% within sex	57.6%	
Total		Count	33	
			64	

	% within sex	100.0%	100.0%	
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There was no statistically significant association between serum uric acid levels and diabetes mellitus ($p = 0.856$). Elevated uric acid levels were present

in 35.7% of diabetic patients and 37.7% of non-diabetic patients, suggesting no correlation between hyperuricemia and diabetes in this study population.

Table 4: Association of Serum Uric Acid Level (Mg/Dl) with Diabetes Mellitus in Study Patients

			DM		P-Value
			Absent	Present	
uric acid level(mg/dl)	≥6.5	Count	26	10	0.856
		% within dm	37.7%	35.7%	
	<6.5	Count	43	18	
		% within dm	62.3%	64.3%	
Total	Count	69	28		
	% within dm	100.0%	100.0%		

DISCUSSION

The present cross-sectional study evaluated the role of serum uric acid (SUA) as an independent risk factor in patients with acute ischemic stroke and its association with established cardiovascular risk factors.

In this study, the majority of patients were aged ≥ 65 years (63.9%), indicating that advancing age is a major non-modifiable risk factor for ischemic stroke. This finding is consistent with studies by Zhang X, et al [7], who reported that stroke incidence increases significantly with age due to vascular degeneration and cumulative exposure to risk factors.

A male predominance (66%) was observed, which aligns with previous studies such as that by Wang Z, et al [8], who demonstrated higher stroke incidence in males, possibly due to greater exposure to lifestyle risk factors like smoking and alcohol.

Hypertension (53.6%) emerged as the most common comorbidity, followed by diabetes mellitus (28.9%). This is in agreement with the findings of Borghi C, et al [9], which identified hypertension as the strongest modifiable risk factor for stroke globally. The prevalence of smoking (25.8%) and alcohol use (14.4%) further supports their contributory role in stroke pathogenesis through endothelial dysfunction and accelerated atherosclerosis.

A statistically significant association was observed between elevated SUA levels and hypertension ($p = 0.005$). This finding supports the hypothesis that hyperuricemia contributes to vascular dysfunction.

A WHO study have demonstrated that uric acid induces endothelial dysfunction, oxidative stress, and activation of the renin-angiotensin system, thereby promoting hypertension [10]. Similarly, Grayson PC et al [11], Reported a strong association between hyperuricemia and incident hypertension in their meta-analysis.

Thus, the present study reinforces the role of SUA as a mediator linking metabolic and vascular risk factors in ischemic stroke.

In contrast, no statistically significant association was found between SUA levels and diabetes mellitus ($p = 0.856$). This finding is consistent with some studies but contrasts with others that have shown a positive correlation.

For instance, Dehghan A, et al [12], found that elevated SUA is associated with an increased risk of type 2 diabetes. However, the lack of association in the present study may be attributed to sample size limitations or confounding factors such as glycemic control and duration of diabetes

No significant association between SUA levels and gender was observed ($p = 0.437$). This is comparable to findings by Dawson J et al [13], who reported that although SUA levels may differ between sexes physiologically, their association with stroke risk remains independent of gender.

Hemiparesis was the most common clinical presentation, followed by slurring of speech and facial deviation. These findings are consistent with the typical presentation of middle cerebral artery territory infarcts, as described in standard neurology literature such as Adams and Victor's Principles of Neurology [14].

The findings of this study are in agreement with studies by Kim SY et al [15], who reported that elevated SUA is associated with poor outcomes in acute stroke patients. However, some studies have suggested a neuroprotective role of uric acid due to its antioxidant properties, highlighting the ongoing controversy.

CONCLUSION

The present study demonstrates that elevated serum uric acid is significantly associated with hypertension in patients with acute ischemic stroke, supporting its role as a potential independent risk factor. However, no significant association was

observed with diabetes mellitus or gender. Further large-scale prospective studies are required to establish causality and explore therapeutic implications.

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How to cite this article: Dr. Nethra N, Dr. Rajesh M Honnutagi, Dr. Gurusangappa S Mudagall, SERUM URIC ACID AS AN INDEPENDENT RISK FACTOR IN ACUTE ISCHEMIC STROKE: A CROSS-SECTIONAL STUDY, *Asian J. Med. Res. Health Sci.*, 2026; 4 (1):1-5.

Source of Support: Nil, Conflicts of Interest: None declared.