

Serum Uric Acid as a Risk Factor of Stroke

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Abstract

Objective-This study was done to evaluate the role of serum uric acid as a risk factor and prognostically important inflammatory marker in stroke patients.

Materials and method-Medical, demographic and clinical data of 100 stroke patients were recorded. Diagnosis of ischemic stroke was confirmed by CT or MRI brain. NIH stroke severity score(NIHSS),Glasgow coma scale(GCS) was calculated by clinical examination and admission serum uric acid(SUA) was measured. The patient's outcome was recorded as death in hospital or discharge.

Results-Prevalence of hyperuricemia in acute stroke patients was 49% in our study.The mean uric acid in dead patients was 7.54 ± 0.95 mg/dl and that of discharged patients was 6.52 ± 0.69 mg/dl($p < 0.05$).MeanSUA in acute stroke patients who had severe GCS score (7.47 ± 0.87 mg/dl) was higher than that those who had mild/moderate GCS score (6.83 ± 0.68 mg/dl) and the difference was statistically significant($p < 0.05$). Similarly, patients with more NIHSS score had increased SUA.

Conclusion- Serum uric acid was thus considered a risk factor in patients with acute ischemic stroke and higher serum level was associated with the poor outcome.

Keywords-Uric acid, Stroke, NIHSS, GCS.

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I. Introduction

Ischemic stroke is a state of oxidative stress in which a thrombus occludes a brain vessel. The infarct core is a region of brain deprived of blood supply and perfusion so neural tissues and cells here get irreversibly damaged. Ischemic penumbra is defined as the ischemic but reversibly dysfunctional tissue surrounding a core area of infarction and hence saving the penumbra is the goal of revascularization therapy¹.

Uric acid is a potent antioxidant and an effective scavenger of singlet oxygen and free radicals. It is either produced from exogenous sources of high purine intake such as meat, seafood, animal organs or from endogenous sources like tissue catabolism and de novo synthesis of purines from RNA and DNA bases. Hyperuricemia is described as serum uric acid concentration being greater than 6.8 mg/dL¹. Serum uric acid being one of the major aqueous antioxidant in human beings should have a protective role in stroke patients. Few studies have shown higher levels of serum uric acid being neuroprotective in patients with stroke.³⁻⁶ On the other hand, higher uric acid levels also proliferate smooth muscle wall enhancing LDL (low density lipoprotein) oxidation, reduce endothelial nitric oxide synthase leading to endothelial dysfunction, and increase the production of platelet-derived growth factors maximizing platelet adhesion.⁷ Each of these factors could potentially stimulate a cascade of coagulation, leading to thrombus formation and arterial occlusion eventually progressing to intracranial atherosclerosis.

Therefore, the role of uric acid as a risk factor for acute ischemic stroke is controversial. Hence the present study was conducted to determine serum uric acid levels as a risk factor in patients with acute ischemic stroke and its association with the outcome of stroke.

II. Materials and Method

Study design-This was a hospital based, prospective and observational study.

Study place- Department of Medicine, Hazaribagh Medical College and hospital, Hazaribagh.

Study population- A total of 100 stroke patients who fulfill the below mentioned inclusion and exclusion criteria were included in the study by random sampling method.

Inclusion criteria-

- 1) Patients presented with stroke within 48 hours of symptom onset proven by CT or MRI brain.
- 2) Patients of stroke of both sex of age group 20-100 years.

Exclusion criteria-

- 1) Patients with trauma, surgery, neoplasm, active infection, immunosuppressive agent use, hematologic disease, inflammatory disease, severe hepatic and renal dysfunction, metabolic disease and intoxication.
- 2) History of the recent intake of drugs related to uric acid metabolism.
- 3) Patients with previous stroke, TIA and hemorrhagic stroke.

Study duration- The study was done from 1st September 2019 to 30th April 2020.

Blood samples for the estimation of serum uric acid (SUA) was collected at the time of admission. SUA was a scale variable but was categorized into two groups, those having normal and high SUA levels (hyperuricemia) as follows: normal SUA range was $SUA \leq 6.0$ mg/dl in females and $SUA \leq 7.0$ mg/dl in males while high SUA range was $SUA > 6.0$ mg/dl in females and $SUA > 7.0$ mg/dl in males⁸. Medical, demographic and clinical data of the patients were recorded by means of personal interview of patients and attendants after taking informed consent. NIH stroke severity score and Glasgow coma scale was calculated. The patient's outcome / prognosis was recorded as either death in hospital or return home / discharge. Data were analysed using Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) version 23.0 software.

III. Results

This study included 100 ischemic patients. The mean age of the patients was 62.41 ± 4.55 years. 60% and 40% were male and female respectively.

Table no.1: shows gender wise distribution of stroke patients.

Gender	No. of patients	Percentage(%)
Male	60	60
Female	40	40

Figure no.1: shows gender wise distribution of stroke patients.

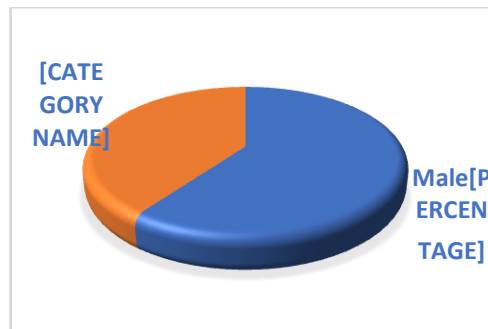


Table no.2: shows prevalence of hyperuricemia in ischemic stroke patients.

	General population	Acute ischemic stroke
Prevalence of hyperuricemia	30%	49%

Figure no.2: shows prevalence of hyperuricemia in ischemic stroke patients.

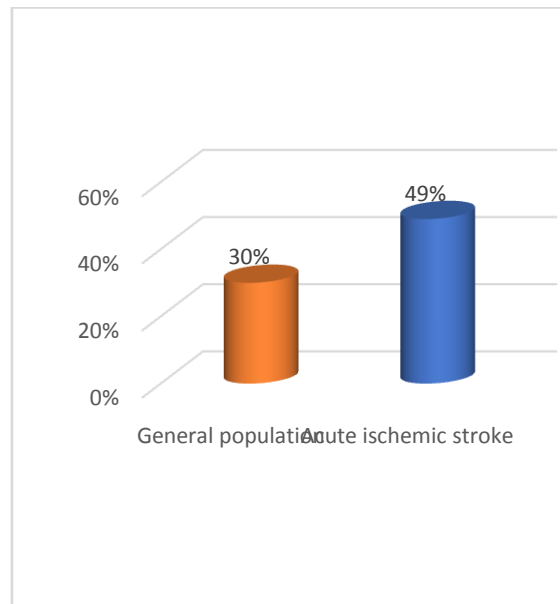


Table no.3: shows mean uric acid of dead and discharged patients. The mean uric acid in dead patients was 7.54 ± 0.95 mg/dl and that of discharged patients was 6.52 ± 0.69 mg/dl and the difference was statistically significant ($p < 0.05$)

	Dead patients	Discharged patients
No. of patients	45	55
Mean serum uric acid(SUA)	7.54 ± 0.95 mg/dl	6.52 ± 0.69 mg/dl

Figure no.3: shows mean uric acid of dead and discharged patients.

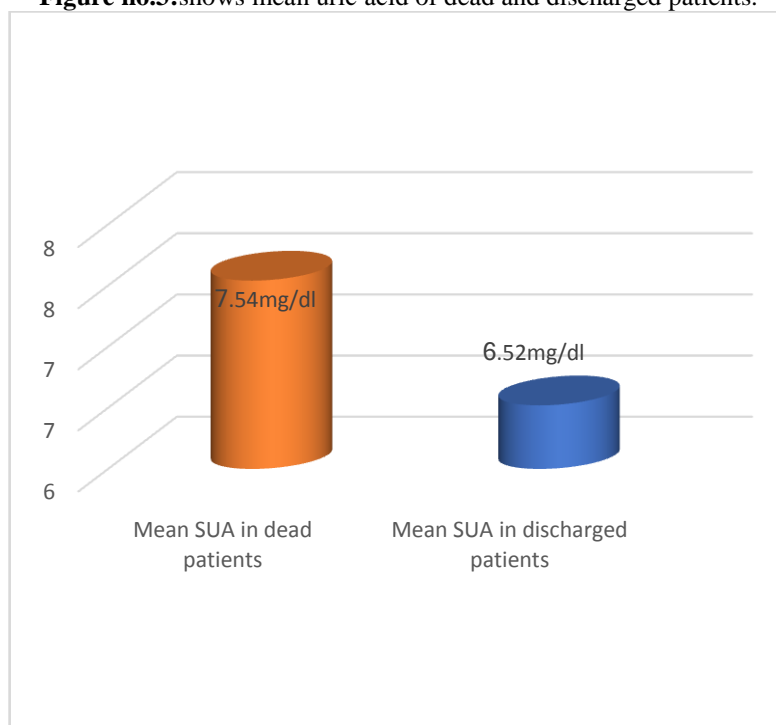


Table no.4:shows association of serum uric acid and NIHSS score. It was highest in patients with severe stroke significantly($p<0.05$)

Score	Stroke severity	No. of patients	Mean SUA
0	No stroke symptoms	0	0
1-4	Minor stroke	21	6.54±0.60
5-15	Moderate stroke	17	6.96±0.88
16-20	Moderate to severe stroke	27	6.98±0.55
21-42	Severe stroke	35	7.47±0.87

Figure no.4:shows association of serum uric acid and NIHSS score.

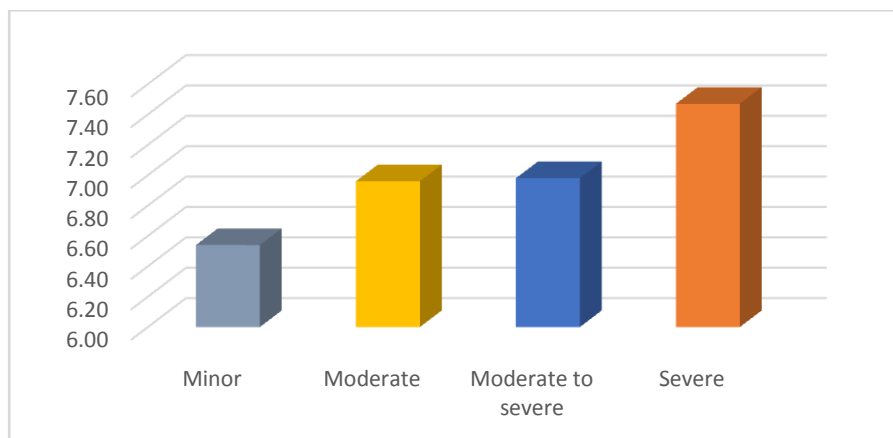
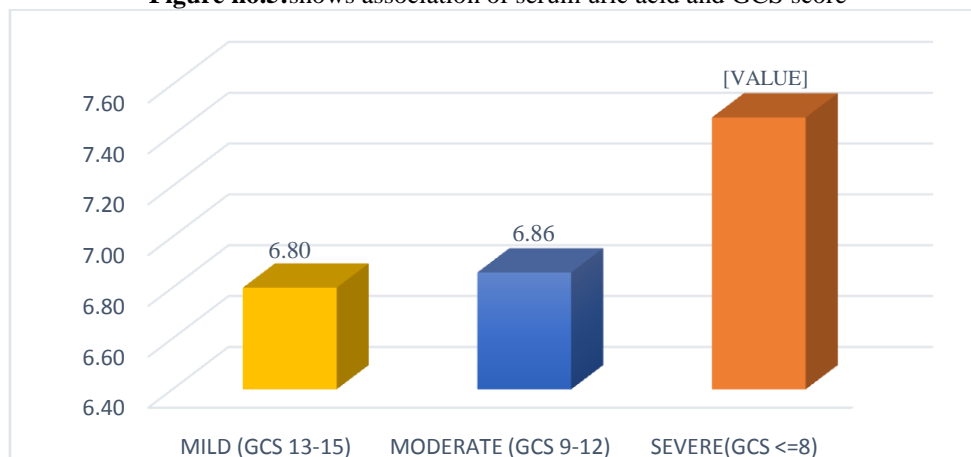


Table no.5:shows association of serum uric acid and GCS score. It was highest in patients with poorest GCS significantly($p<0.05$)

	Mild(GCS 13-15)	Moderate(GCS 9-12)	Severe(GCS ≤8)
No.of patients	32	33	35
Mean SUA	6.80±0.80	6.86±0.56	7.47±0.87

Figure no.5:shows association of serum uric acid and GCS score



IV. Discussion

The mean age of the patients was 62.41 ± 4.55 years. Study done by Yacouba N. Manpoure⁹ et al showed the mean age of patients as 60.58 ± 13.27 years. Ruying wang et al¹⁰ reported 64.41 ± 10.76 years as mean age of the patients. Similarly, Kaur I et al¹¹ reported 65.30 ± 12.11 years as mean age in their study.

In our study, 60% and 40% were male and female respectively.

The prevalence of hyperuricemia in ischemic stroke patients in the present study was 49% which was higher than general population 30% as shown by Raja S. Kumar⁸

The prevalence of hyperuricemia among acute stroke patients was 46.6% as per study done by Yacouba N. Manpoure et al⁹. In Ghana, Sarfo et al¹² reported a high frequency of hyperuricemia of 46.3% among Ghanaian stroke patients. Masoud et al¹³ reported among 55 patients, 47.3% were hyperuricemic. Thus, the result of our study were comparable with the results of above mentioned studies.

In our study, the mean uric acid in dead patients was 7.54 ± 0.95 mg/dl and that of discharged patients was 6.52 ± 0.69 mg/dl ($p < 0.05$). Study done by Yacouba N. Manpoure et al⁹ showed that the mean uric acid level in dead and discharged patients were 7.50 ± 2.8 mg/dl and 6.57 ± 2.1 mg/dl respectively. Karagiannis et al¹⁴ also found that elevated SUA was strongly associated with early death among 435 patients presenting with stroke in Greece. Hyperuricemia was found to be a predictor of stroke and all-cause mortality reported by Longo-Mbenza et al¹⁵. The highest SUA quintile concentration was significantly related to mortality from CHF and stroke according to Strasak et al¹⁶.

In the present study, severity of stroke among cases was assessed by GCS score. Out of 100 patients; 35 patients had severe GCS score, 33 patients (34%) had moderate GCS score and 32 patients had mild GCS score. Mean serum uric acid in acute stroke patients who had severe GCS score (7.47 ± 0.87 mg/dl) was higher than that those who had mild/moderate GCS score (6.83 ± 0.68 mg/dl) and the difference was statistically significant ($p < 0.05$). Patients with poor GCS had higher mean serum uric acid levels as compared to patients with mild or moderate GCS score which was statistically significant as per study done by Kaur I et al¹¹

SUA was highest in patients with severe stroke significantly similar to the study done by Ruying Wang et al¹¹ where there was a statistically significant difference in UA levels between patients with mild cerebral infarctions (NIHSS < 5) and those with moderate or severe cerebral infarctions (NIHSS > 5). SUA is an adverse predictor of early stroke death and functional outcome.¹⁷⁻¹⁸

V. Conclusion

Serum uric acid can be used as a marker for increased risk of stroke. Higher serum uric acid can also be associated with poor outcome. In order to further evaluate the role of serum uric acid in stroke, long term prospective study with more number of patients is required.

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