Section: General Medicine

Original Research Article

SERUM URIC ACID LEVELS IN SUBJECTS HAVING ACUTE ISCHEMIC STROKE

Sanjiv Kumar Singh[1], Yatish[2], Sunil R Dube[3], D. S. S. K Raju[4]

[1]Assistant Professor General Medicine, Shri Rawatpura Sarkar Institute of Medical Science. Raipur, Chhattisgarh, India
[2]Associate professor, Department of General Medicine, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh, India
[3]Professor, Department of General Medicine, Terna Medical College, Nerul, Navi Mumbai, Maharashtra, India
[4]Associate Professor, Department of Biochemistry, Maharajah's Institute of Medical Sciences, Nellimarla, Vizianagaram, Andhra Pradesh, India

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Corresponding Author:
Dr. D. S. S. K. Raju,
Email: dsskraju@gmail.com

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ABSTRACT

Background: AIS (acute ischemic stroke) is an association between SUA (serum uric acid) and AIS remains controversial. The aim is to assess serum uric acid levels in subjects with first episode of acute ischemic stroke and assessment of serum uric acid levels to acute ischemic stroke severity. **Materials and Methods:** This study included subjects with first episode of acute ischemic stroke as confirmed on MRI or CT. Serum uric acid levels were assessed in 100 cases and other 100 age and gender matched controls assessed within 24 hours of admission. In cases, stroke severity was assessed using NIHSS scores and disability was assessed using mRS score. **Result:** Hyperuricemia was seen in 88% subjects with significantly higher mean serum uric acid levels in cases compared to controls with 7.76±1.24 mg/dl and 5.22±1.16 respectively with $p<0.0001$. Based on mRS and NIHSS, majority of subjects had severe stroke in 56% and 40% had moderate functional disability. In cases, serum uric acid had significant and moderate positive correlation to NIHSS score and mRS with $p<0.0001$. However, serum uric acid levels had no significant associated comorbidities as ischemic heart disease, obesity, and hypertension with $p>0.05$. **Conclusion:** The present study concludes that hyperuricemia has high prevalence in subjects with acute ischemic stroke and has significant and positive correlation to mRS.

INTRODUCTION

A stroke is defined as a neurological deficit which has an abrupt onset and is explicable to a focal vascular etiology. Following WHO (World Health Organization), stroke is considered as second most common cause of disability and disease in affected subjects. Literature has substantial evidence concerning high stroke incidence in middle and low-income countries. Considering Global Stroke Factsheet 2022, a 43% increase in death rate and 70% increase in incidence is being seen in subjects with stroke. In Indian context, stroke has 5th rank in etiology for disability-adjusted life years. For morbidity, nearly 40% of subjects that survive stroke are not anticipated to get their self-care and 25% of affected subjects are not able to walk independently.[1]

For humans, uric acid is an inert compound which is a purine metabolite ad function as an antioxidant. Recently, interest has been grown towards the role of uric acid in the modification of the disease. Literature data has established a link between cardiovascular risk factors and hyperuricemia. These risk factors are hypertension, dyslipidemia, and/or obesity.[2]

Also, uric acid is a free radical scavenger and pose neuroprotective effects. Previous literature data from India has shown that there is neuroprotective effect exhibited by hyperuricemia in subjects with stroke. Some of the studies from previous literature has shown that hyperuricemia has protective role in acute ischemic stroke, whereas, other studies have reported management of acute stroke using uric acid.[3]

Few studies in the literature have reported no association in risk of first stroke and uric acid, however, other studies have reported its association with recurrent stroke severity. These controversies posed the necessity to assess any association to stroke concerning its independent effect on the risk factors for cardiovascular disease.4 Hence, the present study was aimed to assess the levels of uric acid in the first acute ischemic stroke and the produced functional disability.

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MATERIALS AND METHODS

The present hospital-based study was aimed to assess serum uric acid levels in subjects with first episode of acute ischemic stroke and assessment of serum uric acid levels to acute ischemic stroke severity. The study subjects were from Department of Medicine of the Institute. Verbal and written informed consent were taken from all the subjects and school authorities before study participation.

The inclusion criteria for the study were subjects aged ≥18 years, from both the genders and presented to the Institute within the defined study period with first episode of magnetic resonance imaging or CT (computed tomography) proved acute ischemic stroke. The exclusion criteria for the study were subjects with malignancy, pregnant and lactating females, Down syndrome, Bartter's syndrome, hypothyroidism, hyperparathyroidism, acidosis, diabetes insipidus, polycystic kidney disease, rhabdomyolysis, and Paget's disease as causes of hyperuricemia, gout cases, end stage liver disease (cirrhosis liver or hepatic encephalopathy), history of renal disease (estimated glomerular filtration rate 1.5 mg/dL), and subjects on medications that can affect serum uric acid levels as benzbromarone, probenecid, levodopa, pyrazinamide, salicylates, and loop diuretics.

Following inclusion and exclusion criteria, 100 study subjects were selected as cases and other 100 subjects were taken as controls which were relatives of the subjects admitted or their visitors that had no previous history of stroke as confirmed on clinical assessment.

After final inclusion, total 100 cases with acute ischemic stroke diagnosis underwent pathological tests. In controls and cases, baseline blood pressure was recorded in supine position and serum uric acid levels were assessed in 24 hours of admission. Also, demographic data and comorbidities as IHD (ischemic heart disease), obesity, diabetes mellitus, and hypertension were recorded in all the subjects from both the groups. In cases, stroke severity was assessed following NIHSS (National Institutes of Health Stroke Scale) scores and mRS (modified Ranking Score) were used to assess disability.

Collected data were statistically analyzed using the chi-square test, Fisher's exact test, Mann Whitney U test, and SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk. NY, USA) using ANOVA, chi-square test, and student's t-test. The significance level was considered at a p-value of <0.05.

RESULTS

The present hospital-based study was aimed to assess serum uric acid levels in subjects with first episode of acute ischemic stroke and assessment of serum uric acid levels to acute ischemic stroke severity. The present study assessed all the subjects that reported to the Institute with acute ischemic stroke within the defined study period. The study included subjects with first episode of acute ischemic stroke as confirmed on MRI (magnetic resonance imaging) or CT (computed tomography). The mean age of study subjects among cases and controls was statistically comparable with p=0.742. In controls and cases, majority of study subjects were in the age range of 50-59 years followed by 40-49 years, 60-69, and 70-79 years, however, the difference among controls and cases was statistically non-significant with 0.834. There were 42 males and 58 females in controls and 46 males and 54 females in cases which was non-significant with p=0.665 [Table 1].

It was seen that for association of clinical characteristics to serum uric acid in study subjects, mean serum uric acid was significantly higher in controls compared to cases with p<0.0001. In cases, mRS showed severe disability, moderately severe disability, moderate disability, slight disability, no significant disability, and no symptoms in 2, 26, 40, 22, 8, and 2 study subjects respectively. NIHSS scores in cases depicted minor stroke, moderate to severe stroke, moderate stroke, and severe stroke in 6, 22, 16, and 56 subjects respectively [Table 2].

Table 1: Demographic data of study subjects

Characteristics	Controls		Cases		p-value
	n	%	n	%	
Mean age (years)	58.35±13.95		59.80±14.04		0.742
Age range (years)					
20-29	6	6	4	4	0.834
30-39	6	6	10	10	
40-49	22	22	20	20	
50-59	26	26	32	32	
60-69	20	20	18	18	
70-79	12	12	10	10	
80-89	8	8	6	6	
Gender					
Males	42	42	46	46	0.665
Females	58	58	54	54	

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Table 2: Association of clinical characteristics to serum uric acid in study subjects

Parameters	Controls		Cases		p-value
	n	%	n	%	
Mean SUA (mg/dl)	7.76±1.24		5.22±1.16		<0.0001
mRS					
Severe disability	-	-	2	2	
Moderately severe disability	-	-	26	26	
Moderate disability	-	-	40	40	
Slight disability	-	-	22	22	
No significant disability	-	-	8	8	
No symptoms	-	-	2	2	
NIHSS					
Minor stroke	-	-	6	6	
Moderate to severe stroke	-	-	22	22	
Moderate stroke	-	-	16	16	
Severe stroke	-	-	56	56	

Table 3: Association of risk factors with serum uric acid

Risk factors	SUA (mg/dl)	p-value
Obesity		
Absent	7.77±1.1	0.799
Present	7.4±0.34	
IHD		
Absent	7.63±1.24	0.225
Present	8.13±1.22	
Hypertension		
Absent	7.52±1.20	0.222
Present	7.96±1.26	
Diabetes mellitus		
Absent	7.83±1.04	0.642
Present	7.62±1.61	

Table 4: Association of various scores to serum uric acid in study subjects

Scores	SUA (mg/dl)	p-value
NIHSS		
Minor stroke (n=6)	7.25±2.87	0.01
Moderate stroke (n=2)	6.91±1.15	
Moderate to severe stroke (n=16)	7.46±0.69	
Severe stroke (n=6)	8.24±1.00	
mRS		
Severe disability (n=2)	9.2±0.00	0.0005
Moderately severe disability (26)	8.3±0.85	
Moderate disability (40)	7.90±1.06	
Slight disability (22)	6.93±1.09	
No significant disability (8)	6.20±1.19	
No symptoms (2)	9.0±0.00	

The study results showed that for association of risk factors to serum uric acid levels, it was seen that non-significantly higher serum uric acid levels were seen in subjects with obesity, ischemic heart disease, hypertension, and diabetes mellitus with respective p-values of 0.799, 0.225, 0.222, and 0.642 respectively [Table 3].

On assessing the association of various scores to serum uric acid in study subjects, it was seen that NIHSS scores were significantly higher in subjects with severe stroke followed by moderate to severe stroke, moderate stroke, and was least in minor stroke subjects. The difference was statistically significant with p=0.01. For mRS scores, highest scores were seen in subjects with severe disability followed by no symptoms, moderately severe disability, moderate disability, slight disability, and were least in no significant disability. These results were statistically significant with p=0.0005 [Table 4].

DISCUSSION

The present study assessed all the subjects that reported to the Institute with acute ischemic stroke within the defined study period. The study included subjects with first episode of acute ischemic stroke as confirmed on MRI (magnetic resonance imaging) or CT (computed tomography). The mean age of study subjects among cases and controls was statistically comparable with p=0.742. In controls and cases, majority of study subjects were in the age range of 50-59 years followed by 40-49 years, 60-69, and 70-79 years, however, the difference among controls and cases was statistically non-significant with 0.834. There were 42 males and 58 females in controls and 46 males and 54 females in cases which was non-significant with p=0.665. These data were comparable to the previous studies of Sekhar AR et al5 in 2020 and Rao TM et al6 in 2016 where authors

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assessed subjects with demographic data comparable to the present study in their respective studies.

The study results showed that for association of clinical characteristics to serum uric acid in study subjects, mean serum uric acid was significantly higher in controls compared to cases with $p<0.0001$. In cases, mRS showed severe disability, moderately severe disability, moderate disability, slight disability, no significant disability, and no symptoms in 2, 26, 40, 22, 8, and 2 study subjects respectively. NIHSS scores in cases depicted minor stroke, moderate to severe stroke, moderate stroke, and severe stroke in 6, 22, 16, and 56 subjects respectively. These results were consistent with the findings of Wu S et al,[7] in 2017 and Reddy KV et al,[8] in 2021 where association of clinical characteristics to serum uric acid reported by the authors in their studies was comparable to the results of the present study.

It was seen that for association of risk factors to serum uric acid levels, it was seen that non-significantly higher serum uric acid levels were seen in subjects with obesity, ischemic heart disease, hypertension, and diabetes mellitus with respective p-values of 0.799, 0.225, 0.222, and 0.642 respectively. These findings were in agreement with the results of El Habr AK et al,[9] in 2021 and Saber H et al,[10] in 2020 where for results for association of risk factors to serum uric acid levels comparable to the present study were also reported by the authors in their respective studies.

Concerning the assessment of the association of various scores to serum uric acid in study subjects, it was seen that NIHSS scores were significantly higher in subjects with severe stroke followed by moderate to severe stroke, moderate stroke, and was least in minor stroke subjects. The difference was statistically significant with $p=0.01$. For mRS scores, highest scores were seen in subjects with severe disability followed by no symptoms, moderately severe disability, moderate disability, slight disability, and were least in no significant disability. These results were statistically significant with $p=0.0005$. These results correlated with the previous findings of Kori P et al,[11] in 2021 and Irfan et al,[12] in 2020 where association of mRS and NIHSS scores to serum uric acid reported by the authors in their studies was similar to the results of the present study.

CONCLUSION

Within its limitations, the present study concludes that hyperuricemia has high prevalence in subjects with acute ischemic stroke and has significant and positive correlation to mRS. However, the study had few limitations as small sample size, longer monitoring, and single-institute nature. Hence, further longitudinal studies with larger sample size, longer monitoring, and multi-institute set up are needed to reach a definitive conclusion.

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