Research Article

INTERNATIONAL RESEARCH JOURNAL OF PHARMACY

www.irjponline.com

ISSN 2230-8407 [LINKING]

ASSESSMENT OF BLOOD URIC ACID LEVELS IN INDIVIDUALS EXPERIENCING THEIR FIRST ACUTE ISCHEMIC STROKE EPISODE AND CORRELATION BETWEEN SERUM URIC ACID LEVELS AND THE SEVERITY OF ACUTE ISCHEMIC STROKE

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How to cite: Mangal AC, Kuldeep, Vallabhbhai KM. Assessment of blood uric acid levels in individuals experiencing their first acute ischemic stroke episode and correlation between serum uric acid levels and the severity of acute ischemic stroke. International Research Journal of Pharmacy. 2022; 13:3:54-58.

DOI:10.7897/2230-8407.1312189

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ABSTRACT

Background: Acute ischemic stroke, or AIS, is a condition that has a high death rate everywhere, including in India, and poses a serious burden on society. Nonetheless, there is ongoing debate over the relationship between AIS and SUA (serum uric acid).

Aim: The purpose of this study was to measure blood uric acid levels in participants who had experienced an acute ischemic stroke for the first time and to correlate these levels with the severity of the acute ischemic stroke.

Methods: During the specified study period, all participants who presented to the Institute with an acute ischemic stroke were evaluated for this investigation. Subjects who had their first episode of acute ischemic stroke verified by CT (computed tomography) or MRI (magnetic resonance imaging) were included in the research. Within 24 hours after admission, the serum uric acid levels of 100 patients and 100 age and gender-matched controls were measured. The National Institutes of Health Stroke Scale (NIHSS) scores were used to determine the severity of the stroke in these cases, and the Modified Ranking Score (mRS) was used to determine the impairment.

Results: According to the study's findings, 88% of participants had hyperuricemia, and their mean blood uric acid levels were substantially higher in cases than in controls (7.76±1.24 mg/dl and 5.22±1.16 mg/dl, respectively, with $p<0.0001$). According to mRS and NIHSS, 40% of participants had significant functional impairment and 56% of individuals had severe stroke.

In these instances, there was a moderately significant positive connection ($p<0.0001$) between serum uric acid and both mRS and NIHSS score. Nevertheless, there were no significant comorbidities with serum uric acid levels that were linked to obesity, hypertension, or ischemic heart disease ($p>0.05$).

Conclusion: In people with acute ischemic stroke, hyperuricemia is highly prevalent and significantly positively correlated with mRS, according to the current study's findings.

Keywords: Acute ischemic stroke, hyperuricemia, modified Rankin score, stroke, uric acid

INTRODUCTION

A stroke is described as a neurological impairment that manifests suddenly and can be attributed to a localized vascular cause. According to the World Health Organization, stroke is the second most prevalent cause of illness and disability

among afflicted individuals. There is a lot of information in the literature about the high prevalence of stroke in middle- and low-income nations.

Individuals with stroke are seeing a 70% increase in incidence and a 43% increase in mortality rate, according to the Global Stroke Factsheet 2022. Stroke is fifth among the etiologies of disability-adjusted life years in India. For instance, it is estimated that 25% of stroke victims are unable to walk on their own and that approximately 40% of survivors do not get self-care.[1]

Uric acid is an inert substance that is a purine metabolite that has antioxidant properties for people. Interest in uric acid's function in disease modification has increased recently. There is evidence in the literature that hyperuricemia and cardiovascular risk factors are related. Among these risk factors are obesity, dyslipidemia, and/or hypertension.[2]

Uric acid also possesses neuroprotective properties and is a free radical scavenger. According to results from earlier Indian studies, hyperuricemia has a neuroprotective impact on stroke patients. While some earlier research has indicated that hyperuricemia can prevent acute ischemic stroke, other studies have documented the use of uric acid to treat acute stroke.[3]

While some studies in the literature have found no correlation between uric acid and the risk of a first stroke, others have found a correlation between it and the severity of subsequent strokes. It was necessary to evaluate any correlation between stroke and its independent impact on cardiovascular disease risk factors because of these disputes. 4 so that uric acid levels may be evaluated in cases of acute ischemic stroke that resulted in functional impairment.

MATERIALS AND METHODS

The goal of the current hospital-based study was to measure blood uric acid levels in participants who had experienced an acute ischemic stroke for the first time and to correlate these levels with the severity of the acute ischemic stroke. The research participants came from the Institute's Department of Medicine. Before participating in the study, all participants and school officials gave their verbal and written informed consent.

Subjects who were at least eighteen years old, of either gender, and who arrived at the Institute during the designated research period with a first episode of magnetic resonance imaging or CT (computed tomography) that demonstrated acute ischemic stroke met the study's inclusion criteria. Subjects with cancer, women who were pregnant or nursing, people with Down syndrome, people with Bartter's syndrome, Individuals with a history of renal disease (estimated glomerular filtration rate 1.5 mg/dL), gout cases, end-stage liver disease (cirrhosis liver or hepatic encephalopathy), acidosis, diabetes insipidus, rhabdomyolysis, Paget's disease, and hypothyroidism or hyperparathyroidism as causes of hyperuricemia, as well as those taking medications that can alter serum uric acid levels, such as benzbromarone, probenecid, levodopa, pyrazinamide, salicylates, and loop diuretics, might all be at risk.

Following the inclusion and exclusion criteria, 100 research participants were chosen as cases, and another 100 were chosen as controls. These participants were either relatives of the hospitalized subjects or their guests, and clinical evaluation verified that none of them had ever experienced a stroke. Following final inclusion, pathological testing was performed on 100 individuals with an acute ischemic stroke diagnosis. Serum uric acid levels were measured within 24 hours of admission for both controls and cases, and baseline blood pressure was measured while the patients were in a supine posture.

Additionally, all participants from both groups had their demographic information and comorbidities, such as obesity, diabetes mellitus, hypertension, and IHD (ischemic heart disease), documented. Following the National Institutes of Health Stroke Scale (NIHSS) ratings, stroke severity was evaluated, and disability was evaluated using the Modified Ranking Score (mRS).

ANOVA, the chi-square test, the student's t-test, Fisher's exact test, the Mann Whitney U test, and SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk, NY, USA) were used to statistically analyze the collected data. A p-value of less than 0.05 was regarded as the significance level.

RESULTS

The goal of the current hospital-based study was to measure blood uric acid levels in participants who had experienced an acute ischemic stroke for the first time and to correlate these levels with the severity of the acute ischemic stroke. The current study evaluated every participant who presented to the Institute during the designated study period with an acute ischemic stroke. Subjects who had their first episode of acute ischemic stroke verified by CT (computed tomography) or MRI (magnetic resonance imaging) were included in the research.

With p=0.742, the mean age of study participants in the cases and controls was statistically equivalent. Although the majority of research participants in both the controls and cases were between the ages of 50 and 59, 40 and 49, 60 and 69, and 70 and 79, the difference between the two groups was statistically not significant (0.834).

The differences between the control group (42 men and 58 females) and the case group (46 males and 54 females) were not statistically significant (p=0.665) (Table 1).

When it came to the correlation between clinical traits and serum uric acid in research participants, the mean serum uric acid in controls was substantially greater than in cases (p<0.0001). With regard to 2, 26, 40, 22, 8, and 2 research individuals, mRS indicated severe disability, moderately severe disability, moderate disability, small disability, no significant disability, and no symptoms, respectively. NIHSS scores in instances showed that 6, 22, 16, and 56 patients, respectively, had small stroke, moderate to severe stroke, moderate stroke, and severe stroke (Table 2).

In terms of the relationship between risk factors and serum uric acid levels, the study's findings indicated that subjects with obesity, ischemic heart disease, hypertension, and diabetes mellitus had non-significantly higher serum uric acid levels (p-values of 0.799, 0.225, 0.222, and 0.642, respectively) (Table 3).

Subjects with severe stroke had the highest NIHSS scores, followed by those with moderate to severe stroke, moderate stroke, and the lowest NIHSS scores among research participants when the connection between different scores and blood uric acid was evaluated. The difference, p=0.01, was statistically significant. Severe disability individuals had the highest mRS scores, followed by those with no symptoms, moderately severe disability, moderate disability, small disability, and no significant impairment. These results were statistically significant with p=0.0005 (Table 4).

DISCUSSION

All of the participants who presented to the Institute with an acute ischemic stroke throughout the specified study period were evaluated in this study. Subjects who had their first episode of acute ischemic stroke verified by CT (computed tomography) or MRI (magnetic resonance imaging) were included in the research. With p=0.742, the mean age of study participants in the cases and controls was statistically equivalent. Although the majority of research participants in both the controls and cases were between the ages of 50 and 59, 40 and 49, 60 and 69, and 70 and 79, the difference between the two groups was statistically not significant (0.834). There were 46 men and 54 females in the cases, and 42 males and 58 females in the controls. This difference was not statistically significant (p=0.665).

These findings were similar to those of earlier research by Sekhar AR et al. (2020) and Rao TM et al. (2016), who evaluated participants using demographic information similar to that of the current study.

The study's findings demonstrated that there was a substantial correlation between clinical features and serum uric acid, with the mean serum uric acid in controls being considerably higher than in cases (p<0.0001). In 2, 26, 40, 22, 8, and 2 research individuals, respectively, mRS revealed severe disability, moderately severe disability, moderate disability, mild disability, no significant disability, and no symptoms. Six, 22, 16, and 56 patients, respectively, had NIHSS scores that showed small stroke, moderate to severe stroke, moderate stroke, and severe stroke. These findings were in line with those of Wu S et al.7 and Reddy KV et al.8, whose research found a similar relationship between clinical features and serum uric acid to ours.

Regarding the relationship between risk factors and serum uric acid levels, it was observed that subjects with diabetes mellitus, ischemic heart disease, obesity, and hypertension had non-significantly higher serum uric acid levels (p-values of 0.799, 0.225, 0.222, and 0.642, respectively). similar to the findings of El Habr AK et al.9 and Saber H et al.10, where the authors of those studies also found findings for the connection of risk variables to blood uric acid levels equivalent to the current research.

When the relationship between the study participants' blood uric acid and the different scores was evaluated, it was found that the individuals with severe stroke had considerably higher NIHSS scores, followed by those with moderate to severe stroke and moderate stroke, while the people with small stroke had the lowest scores. p=0.01 indicated that the difference was statistically significant. The participants with the highest mRS scores were those with severe disabilities, followed by those with no symptoms, moderately severe disabilities, moderate disabilities, small disabilities, and no significant disabilities. Statistical significance was achieved with a p-value of 0.0005. The results of this study were consistent with those of earlier research by Kori P et al.11 and Irfan et al.12, which found a similar relationship between mRS and NIHSS scores and blood uric acid.

CONCLUSION

Despite its limitations, the current study finds that hyperuricemia is associated with mRS in a substantial and favorable way and is highly prevalent in individuals who have experienced an acute ischemic stroke. The study did have certain disadvantages, though, such as its single-institution design, lengthy monitoring period, and small sample size. Therefore, further longitudinal research with a bigger sample size, longer monitoring, and a multi-institution setup is required to draw a firm conclusion.

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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	

Table 1: Demographic data of 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 2: Association of clinical characteristics to serum uric acid in study subjects

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 3: Association of risk factors with serum uric acid

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	

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