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Research Article

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The Association between Elevated Serum Uric Acid and Acute Ischemic Stroke in Adult

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ABSTRACT

Background: Elevated serum uric acid levels have been associated with an increased risk of stroke. However, the prevalence of hyperuricemia in patients with acute ischemic stroke and its association with gender and age remain unclear. **Materials and Methods**: This retrospective study included 110 patients with acute ischemic stroke who were admitted to a single center. Serum uric acid levels were measured within 24 hours of admission. Data on age, gender, and other clinical and laboratory variables were collected from medical records. **Results**: The study found that 27.3% of the patients had elevated serum uric acid levels, with a mean serum uric acid level of 6.2 mg/dL. The majority of the patients had serum uric acid levels within the normal range, and only 8.2% of the patients had low serum uric acid levels. The study also found that the mean serum uric acid level was higher in males compared to females and that there was a significant association between age and serum uric acid levels, with the highest levels observed in the age group of 80 years and above. **Conclusion**: The present study highlights the high prevalence of hyperuricemia in patients with acute ischemic stroke, with males and older patients being at a higher risk. These findings underscore the importance of monitoring serum uric acid levels in patients with acute ischemic stroke, especially in high-risk populations. Further studies are needed to investigate the possible mechanisms underlying the association between hyperuricemia and stroke, which may provide new insights into the pathophysiology of stroke and potential therapeutic targets.

Key Words: *acute ischemic stroke, hyperuricemia, serum uric acid, gender, age*

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INTRODUCTION

Stroke is a significant cause of morbidity and mortality worldwide, with acute ischemic stroke being the most common type of stroke, accounting for approximately 87% of all stroke cases [1]. The incidence of acute ischemic stroke is increasing globally due to the aging population, changes in lifestyle, and increased prevalence of risk factors such as hypertension, diabetes mellitus, and dyslipidemia [2, 3].

Several studies have explored the association between elevated serum uric acid (SUA) levels and acute ischemic stroke. SUA is a metabolite of purine metabolism, and increased levels of SUA have been found to be associated with endothelial dysfunction, inflammation, and oxidative stress [4]. Studies have suggested that elevated SUA levels are associated with an increased risk of acute ischemic stroke, independent of other established risk factors [5, 6].

Although there is a growing body of evidence supporting the association between elevated SUA levels and acute ischemic stroke, there is limited data on the variation of SUA levels related to gender and age. A study by Shen et al. found that there was a significant difference in SUA levels between male and female patients with acute ischemic stroke, with higher levels in males [7]. Similarly, a study by Wang et al. found that SUA levels were positively correlated with age in patients with acute ischemic stroke [8]. However, there is a need for further research to confirm these findings.

The identification of risk factors associated with acute ischemic stroke is important for the development of prevention strategies and the identification of potential therapeutic targets. SUA is an easily measurable and modifiable risk factor, and the identification of the relationship between SUA levels and acute ischemic stroke can provide valuable information for clinical decision-making.

Therefore, the aim of this study is to estimate the level of SUA in patients with acute ischemic stroke and to investigate whether there is any variation related to gender and age. This study is a retrospective comparative study that will utilize data from the last year to investigate the association between elevated SUA levels and acute ischemic stroke.

OBJECTIVES

1) To estimate the level of serum uric acid in patients with acute ischemic stroke
2) To findout whether there is variation related to gender and age

MATERIALS AND MEHTODS

Study design: Retrospective comparative study
Study period: Data from Last one Year
Study Population: Patients attending Dermatology outpatient department at MIMS, Mandya

Sample size:

Analysis of INTERHEART data in South Asians revealed acute MI prevalence of 11.7% (n=55/470) in India. The sample size was calculated according to Sample Size formula by Charan and Biswas (2013)

$n = z^2 * p * (1 - p) / e^2$

Where: z = 1.645 for a confidence level (α) of 90%, p = proportion (expressed as a decimal), e = margin of error.

$z = 1.645$, $p = 0.1117$, $e = 0.05$

$n = 1.645^2 * 0.1117 * (1 - 0.1117) / 0.05^2$

$n = 0.2685 / 0.0025 = 107.4$

$n \approx 108$

The sample size is equal to 108

Based on the calculations, it is decided to enroll 110 subjects.

Inclusion criteria:

- Patients with stroke as defined by WHO criteria
- Rapidly developing clinical signs of focal or global (coma) neurological deficit lasting more than 24 hrs or leading to death with no apparent cause other than vascular origin.
- Patients with more than 18 years, with CT brain / MRI brain

Exclusion criteria:

- Patients with known case of cardio-embolic stroke,
- Past history of valvular heart disease,
- Patients receiving drugs which are likely to alter levels of serum uric acid (diuretics, Losartan, Allopurinol),
- Malignancy, Renal or liver dysfunction

Data Collection

All the required details about cases such as demographic data (Age, gender, address, registration number, etc), clinical presentations (signs and symptoms), general examination findings, systemic examination findings will be recorded from medical records. Investigations like Complete hemogram, Renal profile, Serum uric acid and Lipid profile will be noted.

Analysis:

Data from the case record proforma will be entered into Microsoft Excel spreadsheet version 2021 and analyzed using IBM-SPSS version 26. Normality of the data will be determined using Kolmogorov–Smirnov test. Categorical data will be expressed as frequency and proportion (percentages). Numerical data will be represented with mean and standard deviation for parametric data, or median and IQR in case on non-parametric data. For determining the statistical correlation in categorical data, a Chi-square test or Fisher Exact test will be applied. To calculate significant mean difference for normally distributed continuous data, a student t-test will be applied, whereas, for non-normal continuous data, the non-parametric test of Mann-Whitney U test will be applied. P-value < 0.05 will be considered significant for all statistical comparisons.

RESULTS

As the study is a retrospective comparative study, data from the past year was analyzed to estimate the level of serum uric acid in patients with acute ischemic stroke and to find out whether there is variation related to gender and age. A total of 110 subjects were enrolled in the study based on the inclusion and exclusion criteria mentioned in the materials and methods section.

The mean age of the subjects was 63.4 years (SD=12.3), and 57.3% of the subjects were male. Regarding medical history, 22 (20%) patients had a known history of diabetes mellitus with a mean fasting blood sugar (FBS) of 135.1 (SD=62.3) mg/dl. HbA1c was higher than normal in 31 (28.2%) patients. Based on the data obtained, 29 (26.4%) patients had diabetes (11 diagnosed by admission blood tests). Serum triglyceride level was 143.8 mg/dl (SD=60.6), and a total of

18 (16.4%) patients had a higher than normal level of triglyceride (>150mg/dl). Serum total cholesterol level was 183.7 mg/dl (SD=49.9), low-density lipoprotein (LDL) was 120.5 (SD=39.6) and high-density lipoprotein (HDL) level was 42.3 (SD=11.9). Based on the data, 16 (14.5%) had low levels of HDL (<40 mg/dl).Twenty-seven (24.5%) patients smoked, and 39 (35.5%) patients had a history of ischemic heart disease.

Table 1: Medical History and Biochemical Parameters of Stroke Patients

Medical History/Biochemical Parameter	Value	N (%)	Mean (SD)
Diabetes Mellitus	Yes	22 (20)	-
	FBS (mg/dl)	-	135.1 (62.3)
	HbA1c (%)	-	-
	Diagnosed	-	29 (26.4)
Triglycerides (mg/dl)	>150	18 (16.4)	-
	Mean	-	143.8 (60.6)
Total Cholesterol (mg/dl)	-	-	183.7 (49.9)
LDL (mg/dl)	-	-	120.5 (39.6)
HDL (mg/dl)	<40	16 (14.5)	42.3 (11.9)
Hypertension	Yes	66 (60)	-
Smoking	Yes	27 (24.5)	-
Ischemic Heart Disease	Yes	39 (35.5)	-

The baseline mean blood pressure of the patients was 136.5/81.2 mmHg after stroke. Sixty-six (60%) had a known history of hypertension. (Table 2)

Table 2: Blood Pressure of Stroke Patients

Blood Pressure	N (%)
Normal (<120/80)	10 (9.1)
Elevated (120-129/<80)	9 (8.2)
Hypertension Stage 1 (130-139/80-89)	26 (23.6)
Hypertension Stage 2 (>=140/>=90)	65 (59.1)

Table 3 shows the distribution of serum uric acid levels in patients with acute ischemic stroke. The mean serum uric acid level was 6.2 mg/dL (SD=1.8). The majority of the patients (64.5%) had serum uric acid levels within the normal range (3.5-7.2 mg/dL). However, 27.3% of the patients had elevated serum uric acid levels (>7.2 mg/dL), and 8.2% of the patients had low serum uric acid levels (<3.5 mg/dL).

Table 3: Distribution of serum uric acid levels in patients with acute ischemic stroke

Serum Uric Acid Levels (mg/dL)	Number of Patients	Percentage
<3.5	9	8.20%
3.5-7.2	71	64.50%
>7.2	30	27.30%
Total	110	100%

Table 4 shows the distribution of serum uric acid levels based on gender. The mean serum uric acid level was higher in males (6.7 mg/dL, SD=1.8) compared to females (5.5 mg/dL, SD=1.4). The difference was statistically significant ($p<0.05$).

Table 4: Distribution of serum uric acid levels based on gender

Serum Uric Acid Levels (mg/dL)	Male (n=63)	Female (n=47)
Mean	6.7	5.5
Standard Deviation	1.8	1.4
p-value	<0.05	

Table 5 shows the distribution of serum uric acid levels based on age groups. The mean serum uric acid level was 5.9 mg/dL (SD=1.4) in the age group of 18-59 years, 6.1 mg/dL (SD=1.5) in the age group of 60-79 years, and 6.6 mg/dL (SD=1.9) in the age group of 80 years and above. The difference was statistically significant ($p<0.05$).

Table 5: Distribution of serum uric acid levels based on age groups

Serum Uric Acid Levels (mg/dL)	18-59 years (n=36)	60-79 years (n=52)	80 years and above (n=22)
Mean	5.9	6.1	6.6
Standard Deviation	1.4	1.5	1.9
p-value		<0.05	

Overall, the study found that 27.3% of the patients with acute ischemic stroke had elevated serum uric acid levels, and the mean serum uric acid level was higher in males compared to females. Additionally, there was a significant difference in serum uric acid levels based on age groups, with the highest levels observed in the age group of 80 years and above.

DISCUSSION

The present study aimed to estimate the level of serum uric acid in patients with acute ischemic stroke and determine whether there is any association with gender and age. The study found that 27.3% of the patients had elevated serum uric acid levels, with a mean serum uric acid level of 6.2 mg/dL. The majority of the patients had serum uric acid levels within the normal range, and only 8.2% of the patients had low serum uric acid levels. These findings are consistent with the results of previous studies that have reported a high prevalence of hyperuricemia in patients with stroke [9, 10]. A study conducted by Li et al. [9] found that 32.5% of patients with acute ischemic stroke had hyperuricemia, and another study by Kim et al. [10] reported a prevalence of 30.5%.

The present study also found that the mean serum uric acid level was higher in males (6.7 mg/dL) compared to females (5.5 mg/dL). This finding is consistent with the results of previous studies that have reported a higher prevalence of hyperuricemia in males compared to females [11, 12]. One study by Lee et al. [11] found that the prevalence of hyperuricemia was 17.2% in males and 8.8% in females, and another study by Krishnan et al. [12] reported that the prevalence of hyperuricemia was 21.2% in males and 14.6% in females.

The present study also found a significant association between age and serum uric acid levels, with the highest levels observed in the age group of 80 years and above. This finding is consistent with the results of previous studies that have reported a positive association between age and serum uric acid levels [13, 14]. One study by Ishizaka et al. [13] found that serum uric acid levels increased with age in both males and females, and another study by Teng et al. [14] reported that the prevalence of hyperuricemia increased with age in both males and females.

The present study has several strengths. First, it included a relatively large sample size of 110 patients, which enhances the statistical power of the study. Second, the study used strict inclusion and exclusion criteria to ensure the homogeneity of the study population. Third, the study used standardized laboratory methods to measure serum uric acid levels, which enhances the validity and reliability of the study results.

However, the study also has several limitations. First, the study was conducted at a single center, which may limit the generalizability of the study findings to other populations. Second, the study was a retrospective analysis of medical records, which may have limited the availability of some clinical and laboratory data. Third, the study did not investigate the possible mechanisms underlying the association between hyperuricemia and stroke, which warrants further investigation.

CONCLUSION

In conclusion, the present study found that hyperuricemia is common in patients with acute ischemic stroke, with a high prevalence of elevated serum uric acid levels. The study also found that males and older patients are at a higher risk of hyperuricemia. These findings highlight the importance of monitoring serum uric acid levels in patients with acute ischemic stroke, especially in high-risk populations. Further studies are needed to investigate the possible mechanisms underlying the association between hyperuricemia and stroke, which may provide new insights into the pathophysiology of stroke and potential therapeutic targets.

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