

Original Research Article

A study to find out relationship in between serum uric acid level and stroke

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ABSTRACT

Background: The role of uric acid as a risk factor in cases of acute ischaemic stroke is controversial. The present study was conducted with the aim to study the clinical profile and the incidence of stroke in patients with normal and elevated uric acid and its correlation with other risk factors.

Methods: This study was conducted in 100 patients with acute ischaemic stroke who were admitted in NSCB Hospital Jabalpur from August 2009 to July 2010. Clinical records of patients and their serum uric acid level was investigated. The severity of neurological deficit was recorded according to the scandinavian stroke scale (SSS). Patients were followed up during hospital stay and outcome was graded by using modified Rankin's scale (mRS). Finally, collected data were analyzed using Chi square and student t test wherever appropriate. P value <0.05 was considered significant.

Results: A total of 100 patients were included in the study. Majority of the patients (57%) were in the age group of 50 to 70 years. Males (54%) were more affected than females (46%). Out of 100, 71 had normal serum uric acid levels in which 35 (49%) patients were above 60 years of age. 29 of them had hyperuricemia in which 20 (69%) were above the age of 60 years. Of 54 males and 46 females hyperuricemia was observed in 16 (55%) and 13 (45%) patients respectively. A significant correlation was observed between hyperuricemia and hypertension ($p < 0.05$). Non-significant correlation was seen between hyperuricemia, diabetes and hyperlipidemia ($p > 0.05$). Significant, positive correlation $p < 0.05$ was present amongst male alcoholics. Association of uric acid with smoking in acute ischaemic stroke patients was found to be statistically insignificant ($p > 0.05$). Majority (83%) of patients were having infarct in MCA artery territory. Majority of patients 20 (69%) with elevated serum uric acid were having SSS score > 30 . Statistically insignificant ($p > 0.05$) association was observed between mean mRS score in patients with normal serum uric acid Vs patients with hyperuricemia.

Conclusions: The prevalence of hyperuricemia in acute ischaemic stroke patients was lower than in normal population. Age, hypertension and alcoholism amongst males showed statistically significant positive correlation with hyperuricemia in patient with acute ischaemic stroke and hence they are considered to be the significant risk factors.

Keywords: Acute ischaemic stroke, Hyperuricemia, Modified Rankin's scale, Neurological deficit

INTRODUCTION

Stroke entails a high socioeconomic burden due to increased mortality and morbidity. Early identification of individual at risk could be of help in designing primary

prevention strategies.¹ The role of serum uric acid (SUA) level as an independent risk factor for stroke has been questioned for many years.² Evidence from epidemiological studies suggest that elevated SUA levels may predict an increased risk for stroke and

cardiovascular events ,moreover therapeutic modalities with a SUA lowering potential have been shown to reduce cardiovascular disease morbidity and mortality.^{2,3} In this respect SUA levels could be as an 'easy to measure' serum marker in selecting and appropriately treating subjects at risk.

Serum uric acid has also been linked to prognosis of patient with acute ischaemic stroke. Evidence suggests that increased level of uric acid is protective in patients with acute ischaemic stroke; although this issue has been debated, the neuroprotective role of uric acid in patient with acute ischaemic stroke is now established.^{4,5} So, it could be marker of value in prognosis of patient with acute ischaemic stroke.

METHODS

The present study was carried out on 100 patients of acute ischaemic stroke admitted to NSCB Hospital Jabalpur who satisfy the selection criteria. The study was conducted from August 2009 to July 2010. In each case, the diagnosis of recent ischaemic stroke was confirmed by CT scan of brain. Patients having disease known to increase serum uric acid or taking drugs, which can cause hyperuricemia, old cases of stroke, hemorrhagic stroke and embolic stroke cases were excluded from study. On admission in hospital detailed history was taken and thorough physical examination was performed as per Proforma made. The severity of neurological deficit was recorded according to the scandinavian stroke scale (SSS).⁶ All the patients were subjected to hematological tests, blood sugar, urea, serum creatinine, serum electrolytes and serum uric acid. Lipid profile was obtained after 12 hours of fasting. ECG was done in every case to detect atrial fibrillation, IHD and left ventricular hypertrophy. Echocardiography was done as and when indicated. Patients were followed up during hospital stay and outcome was graded by using modified Rankin's scale (mRS).⁷

Statistical analysis

Chi square and student t test were applied wherever appropriate. P value <0.05 was considered statistically significant.

RESULTS

A total of 100 patients were included in the study. Majority of the patients (57%) were in the age group of 50 to 70 years. Males (54%) were more affected than females (46%).

As shown in Table 2, the difference between the age group and incidence of hyperuricemia was found to be statistically significant ($p < 0.05$). Out of 100 patients, 71 had normal serum uric acid levels (≤ 7 mg %) in which 35 (49%) patients were above 60 years of age. 29 of them had hyperuricemia (> 7 mg %) in which 20 (69%) were

above the age of 60 years. Out of 54 males and 46 females hyperuricemia was observed in 16 (55%) and 13 (45%) patients respectively.

Table 1: Distribution of cases according to age and sex in patient with acute ischaemic stroke.

Age groups (in years)	Sex		Total (100)
	Male (%)	Female (%)	
<40	05 (09)	01 (2)	06
41-50	08 (15)	08 (17)	16
51-60	12 (22)	11 (24)	23
61-70	17 (31)	17 (37)	34
71-80	10 (19)	09 (20)	19
>81	02 (04)	00 (00)	02
Total	54	46	100

Table 2: Correlation of age and gender with serum uric acid levels in acute ischaemic stroke patients.

Characters	Level of serum uric acid		Total (100)
	SUA ≤ 7 mg%	SUA > 7 mg%	
Age groups (in years)	N=71 (%)	N=29 (%)	
<40	05 (07)	01 (03)	06
41-50	15 (21)	01 (03)	16
51-60	16 (23)	07 (24)	23
61-70	22 (28)	12 (41)	34
71-80	11 (18)	8 (29)	19
>81	02 (03)	00 (00)	02
Sex			
Male	38 (54)	16 (55)	54
Female	33 (46)	13 (45)	46

Table 3 presents the correlation of clinical parameters with serum uric acid levels in acute ischaemic stroke patients. None of the hyperuricemic patient was normotensive. Out of 29 patients, 11 (38%) were having prehypertension and 18 (62%) were hypertensive as compared to patients with normal serum uric acid levels and this difference was found to be significant ($p < 0.05$). 34% of patients with hyperuricemia were noted as diabetics as compared to patient with normal serum uric acid in which only 20% patients were diabetic and this difference was statistically non-significant. The incidence of dyslipidemia was almost equal amongst patient with hyperuricemia and without hyperuricemia.

Table 4 presents the correlation of risk factors with serum uric acid levels in acute ischaemic stroke patients. All alcoholics in the study were males. Hyperuricemia was observed in 45% of alcoholics and 55% of non-alcoholics. No significant correlation was noticed in between serum uric acid and alcoholism. Significant positive correlation $p < 0.05$ was present amongst male alcoholics. Association of uric acid with smoking in acute ischaemic stroke patients was found to be statistically insignificant ($p > 0.05$). Majority (83%) of patients were

having infarct in MCA artery territory. In 07% of patients MCA and ACA both were involved. In 10% of patients PCA artery was involved. Majority of patients 20 (69%) with elevated serum uric acid were having SSS score >30

as compared to patients with normal serum uric acid who in whom only 35 (49%) were having SSS score >30. This difference was statistically significant with each other ($p<0.05$).

Table 3: Correlation of clinical parameters with serum uric acid levels in acute ischaemic stroke patients.

Clinical parameters	Level of serum uric acid		Total
	SUA ≤ 7 mg%	SUA > 7 mg%	
	N=71 (%)	N=29 (%)	
Blood pressure			
Normal BP	16 (23)	NIL	16
Pre-hypertension: SBP- 120 to 139, DBP- 80 to 89	17 (24)	11 (38)	28
Stage 1 hypertension: SBP 140-159, DBP- 90-99	16 (23)	6 (21)	22
Stage 2 hypertension: SBP >160 , DBP >100	22 (31)	12 (41)	34
Diabetes			
Diabetic	14 (20)	10 (34)	24
Non-diabetic	57 (80)	19 (66)	76
Lipid profile (mg %)			
No dyslipidemia (S. Cholesterol <200 mg%; S. Triglyceride <160 mg%)	32 (45)	07 (29)	39
Hypercholesterolemia (S. Cholesterol >200)	10 (14)	05 (17)	15
Hypertriglyceridaemia (S. triglyceride >160 mg%)	19 (27)	10 (34)	29
Combined dyslipidemia	10 (14)	07 (24)	17

Table 4: Correlation of risk factors with serum uric acid levels in acute ischaemic stroke patients.

Risk factors	Level of serum uric acid		Total
	SUA ≤ 7 mg%	SUA > 7 mg%	
	N=71 (%)	N=29 (%)	
Status of alcohol (only males)			
Alcoholic	20 (28)	13 (45)	33
Non-alcoholic	51 (72)	16 (55)	67
Status of smoking			
Smoker	28 (39)	10 (34)	38
Non-smoker	43 (61)	19 (66)	62
Arterial territory involved			
MCA	60 (85)	23 (79)	83
MCA, ACA	06 (8)	01 (3)	07
PCA	05 (7)	05 (18)	10

Table 5: Correlation of serum uric acid and SSS in acute ischaemic stroke.

SSS	Level of serum uric acid		Total
	SUA ≤ 7 mg%	SUA > 7 mg%	
	N=71 (%)	N=29 (%)	
<20	18 (25)	03 (10)	21
21-30	18 (25)	06 (21)	21
31-40	19 (27)	07 (24)	27
41-50	14 (20)	09 (31)	26
>51	02 (3)	04 (14)	05

Table 6 exhibits the correlation of serum uric acid and outcome by modified Rankin's scale in acute ischaemic stroke. Statistically insignificant ($p>0.05$) association was observed between mean mRS score in patients with

normal serum uric acid 3.82 mg/dl versus 3.41 mg/dl in patients with hyperuricemia.

Table 6: Correlation of serum uric acid with outcome by modified Rankin's scale (mRS).

mRS	Level of serum uric acid		Total
	SUA ≤ 7 mg%	SUA > 7 mg%	
	N=71 (%)	N=29 (%)	
1	04 (06)	00 (00)	04
2	08 (11)	09 (31)	17
3	16 (23)	08 (28)	24
4	20 (28)	06 (21)	26
5	15 (21)	03 (10)	19
6	08 (11)	03 (10)	10

DISCUSSION

The study was conducted in 100 patients of acute ischaemic stroke admitted to NSCB Medical College and Hospital, Jabalpur. A detailed history and systemic examination was carried out in every patient. In each case the diagnosis was confirmed by CT scan brain. On admission patients, neurological status was assessed by the Scandinavian stroke scale (SSS) and outcome was graded by using modified Rankin's scale. Serum uric acid was measured within 24 hours of onset of stroke and value $>7\text{mg/dl}$ was considered hyperuricemia.

The present study included total 100 patients with onset of acute ischaemic stroke. Out of 100 patients, 54% patients were males and 46% patients were females. Majority of patients (57%) were in the age group of 50 to 70 years. 6 patients were below the age of 40 years and 2 patients were above the age of 80 years.

In present study, old age appears to be a big risk factor for both stroke and hyperuricemia. We found prevalence of hyperuricemia in stroke patient was 29%. Mean serum uric acid was $6.25 \pm 2.72\text{ mg/dl}$. Out of 29 hyperuricemic patient 20 (69%) were above the age of 60 as compared to patient with normal serum uric acid in whom 35 (49%) patients were above sixty (P value <0.05 , significant). Overall 65% patients were above the age of 60 years. Mean age of stroke in our study was 61.18 ± 13.43 years. Average serum uric acid in patient above 60 years was $6.58 \pm 2.75\text{ mg/dl}$ as compared to patient under the age of 60 years in whom mean serum uric acid level was $5.84 \pm 2.72\text{ mg/dl}$. Our finding was consistent with finding of Bansale et al.⁸ They reported the prevalence of hyperuricemia of 30% in patient with acute ischaemic stroke, with mean serum uric acid of $6.5 \pm 1.19\text{ mg/dl}$. They reported the mean age of the study participants was 59.40 ± 12.15 years.

The prevalence of hyperuricemia was higher in male. As 16 (55%) out of 29 were male. In present study mean serum uric acid amongst male was $6.39 \pm 2.74\text{ mg/dl}$ and in female mean serum uric acid level was $6.07 \pm 2.68\text{ mg/dl}$. However, this difference in serum uric acid and gender is not statistically significant (student t test $t > 0.05$) males usually have higher prevalence of hyperuricemia as compared to females. This difference is maintained till menopause, after that this difference normalized. The difference is due to uricosuric effect of estrogen in premenopausal woman. On contrary to this study, Millionis et al showed significant relation between serum uric acid level and male gender in patient with acute ischaemic stroke (P=0.01).⁹

In the present study, overall 56% patients were hypertensive and 28% patients were prehypertensive. Out of 29 hyperuricemic patients, 18 (62%) patients were hypertensive, whereas in patients with normal level of serum uric acid 38 (54%) out of 71 were hypertensive. Mean serum uric acid amongst hypertensive was

$6.30 \pm 2.71\text{ mg/dl}$ and in non-hypertensive it was $6.19 \pm 2.72\text{ mg/dl}$. There was significant positive relationship was found in between hypertension and hyperuricemia (P <0.05). Similar observations were also made by Chamorro et al and Chen JH et al.^{4,10}

In this study, out of 29 hyperuricemic patient 10 (34%) patients were diabetic as compared to patient with normal serum uric acid in whom only 14 (20%) patients were diabetic. Mean serum uric acid amongst diabetic was $6.90 \pm 2.75\text{ mg/dl}$ as compared to nondiabetics in whom it was $6.05 \pm 2.72\text{ mg/dl}$. We didn't find any significant relation in diabetic vs. non-diabetics with serum normal and elevated serum uric acid level (p >0.05). But a positive association between plasma uric acid concentration and the incidence of diabetes was noted in a community-based prospective cohort study done by Chien et al in 2690 patients (35-97 years).¹¹

In this study, we found that there was no significant difference in prevalence of dyslipidemia in patient with hyperuricemia and normal uric acid level. Among hyperuricemic group 22 (76%) of patient were dyslipidemic as compared to patient with normal serum uric acid in which only 39 (55%) of patient were dyslipidemic. Overall 61% patient were dyslipidemic in which 15% patients were having elevated cholesterol, 29% were having elevated triglycerides and 17% were having combined dyslipidemia. There was also no statistically significant relationship was found in between hyperuricemia and cholesterol and triglycerides (Chi square test; p >0.05). Our findings are similar to the findings of Chamorro et al, but in comparison to the study by Sreedhar et al we found higher incidence of hypertriglyceridaemia and lower incidence of hypercholesterolemia.^{4,12}

Overall prevalence of alcoholism in present study was 33%. Out of which 13 (39%) patient was hyperuricemic. All alcoholics were males. Mean serum uric acid among alcoholic were $6.75 \pm 2.76\text{ mg/dl}$ as compared to nonalcoholic in which it was $6.02 \pm 2.72\text{ mg/dl}$. In a study done by Chamorro et al, a weak positive correlation in between alcohol and hyperuricemia in acute ischaemic stroke patient was observed. Our finding was consistent with the fact that mean uric acid levels are higher in alcoholic but we are not getting statistically significant result may be due to the fact that in our study woman were exclusively nonalcoholic.

Mean SSS score in hyperuricemic patients was 38.90 versus 30.27 in patient with normal serum uric acid (Chi square test; p value <0.05 ; statistically significant). Majority of hyperuricemic patients (20 patient; 69%) were having SSS score >30 as compared to patients with normal serum uric acid who in whom only (35; 49%) were having SSS score >30 . Our findings are consistent with the observations of Chamorro et al.⁴

In present study, a non-significant association was seen between the outcome of mean modified Rankin's scale and hyperuricemia. There was also no significant difference was found amongst hyperuricemic patient and patient with normal level of serum uric acid in terms of good outcome or bad outcome (chi square test; $p > 0.05$). Possible reasons are small sample size and follow up only during the hospital stay. Large trials are required to provide definite answers in clinical practice. Our findings are contrary with the studies of Weir et al, who studied 3731 patients and measured serum urate in 2498 and reported that elevated urate level predict a lower chance of good 90-day outcome independent of stroke severity and other prognostic factors.¹³

CONCLUSION

Our study concludes that, the prevalence of hyperuricemia in acute ischaemic stroke patients was lower than in normal patients. Out of all the traditional risk factors for stroke analyzed, age, hypertension and alcoholism amongst males showed statistically significant positive correlation with hyperuricemia in patient with acute ischaemic stroke. Patients with hyperuricemia were having better neurological status as compared to patients without hyperuricemia when assessed at the time of admission but there was no statistically significant relationship observed in between outcome of patient and hyperuricemia in patient with acute ischaemic stroke.

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