

The study of serum uric acid level in acute ischemic stroke

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Abstract

Background: It is uncertain whether high uric acid concentrations assist or defend against the occurrence of cardiovascular diseases, or simply act as latent marker of increased risk in contest with such controversy and inadequate available Indian data, it is necessary to carry out further research over the role of uric acid level in patient of acute ischemic stroke. **Method:** 100 cases of acute ischemic stroke were studied along with risk factors for stroke were noted such as hypertension, diabetes mellitus, dyslipidemia, alcohol, smoking. Serum uric acid levels were measured in all cases. Statistical analysis was performed with SPSS 22.0 software. **Results:** Out of 100 patients 66% were males and 34% were females. Male to female ratio is 1.9. Mean age of 63.13years. The prevalence of hyperuricemia in stroke patients was 37%. Mean SUA was 6.02 ± 1.70 mg/dl. Out of 37 hyperuricemic patients, 25 (67%) were above the age of 60 as compared to patients with normal serum uric acid in whom 31 (49%) out of 63 patients were above the age of 60 and there was no significant relationship in between age and uric acid in acute ischemic stroke patients. ($p > 0.05$). SUA level amongst male patients was 6.07 ± 1.67 mg/dl and in female was 5.92 ± 1.78 mg/dl. The difference in SUA level and gender is not statistically significant ($p > 0.05$). Total 72% of patients were hypertensive and out of 37 hyperuricemic patients 32 (86%) were hypertensive and there was a significant association between hyperuricemia and hypertension in patients with acute ischemic stroke. ($p < 0.05$). Among diabetic the mean SUA is 6.20 ± 1.66 mg/dl. While in non-diabetic patients 5.94 ± 1.72 mg/dl. No significant association between diabetics and non-diabetic. There was no statistically significant relationship found between hyperuricemia and dyslipidemia. ($p > 0.05$). Mean SUA level among dyslipidemic patients was 6.07 ± 1.65 mg/dl, while in normal patients was 5.96 ± 1.77 mg/dl. Mean SUA level among alcoholic was 5.68 ± 1.61 mg/dl as compared to non-alcoholics in which it was 6.16 ± 1.73 mg/dl. Mean SUA level amongst smokers was 6.03 ± 1.55 mg/dl vs 6.01 ± 1.79 mg/dl amongst non-smokers. **Conclusions:** The association between hyperuricemia and acute ischemic non embolic stroke may be considered while treating the hypertensive population. Hyperuricemia can be considered as one of the significant and independent risk factor for acute ischemic non-embolic stroke.

Key Word: Serum uric acid; Acute ischemic stroke; Diabetes; Hypertension; Alcohol; Smoking

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INTRODUCTION

Over 50 years, the role of serum uric acid in the development of cerebrovascular disease has been

debated¹. Evidences from epidemiological studies suggested that hyperuricemia is separately and significantly correlated with risk of cardiovascular mortality.² However with different therapeutic methods, one can lessen the risk of cerebrovascular disorder mortality and morbidity by decreasing the serum uric acid level. Serum uric acid is easily available and measurable test. No possible biological mechanisms are comprehended by which hyperuricemia could influence the development of stroke. Therefore it is uncertain whether high uric acid concentrations assist or defend against the occurrence of cardiovascular diseases, or simply act as latent marker of increased risk³ in contest with such controversy and inadequate available Indian

data, it is necessary to carry out further research over the role of uric acid level in patient of acute ischemic stroke.

MATERIALS AND METHODS

This study was done on 100 patients of acute ischemic stroke admitted at tertiary care center who satisfied the selection criteria

Selection of cases- Patient with abrupt onset of focal neurological deficit above 18 year of age fulfilling the inclusion criteria and exclusion criteria.

Inclusion criteria-Patients admitted in our hospital with acute ischemic nonembolic stroke with CT Scan or MRI evidence of cerebral infarction within 48 hrs of onset of stroke.

Exclusion criteria-

- Patients with previous history of transient ischemic attack (TIA) or Cerebrovascular accident (CVA).
- Patients who are on thiazide diuretics or drugs causing hyperuricemia.
- Patients who are known cases of gout or show clinical evidences of gout.
- Patients with chronic renal failure.
- Patients whose CT scan show hemorrhage or other space occupying lesions other than infarct.
- Patients who were of known cardiac diseases which could be the sources of emboli or whose echocardiogram (2DECHO) shown sources of emboli.
- Patients with hematological abnormalities like leukemia or other myeloproliferatedis orders, any malignancy.

Definitions-

1. Cerebrovascular accident or stroke- defined as an abrupt onset of neurological deficit that is attributable to a focal vascular cause.⁴
2. Pre Hypertension defined as a systolic blood pressure -120 to 139 mm of Hg and diastolic blood pressure 80 to 89 mm of Hg on 2 or more occasions.
3. Hypertension was defined as blood pressure of $\geq 140/90$ mm of Hg on 2 or more occasions or ongoing treatment for systemic hypertension or previously diagnosed cases of systemic hypertension.
4. Diabetes mellitus was defined as fasting blood sugar ≥ 126 mg/dl or history of receiving treatment for diabetes mellitus or a known case of diabetes mellitus.
5. Dyslipidemia are generally characterized clinically by increased plasma levels of cholesterol, triglycerides, or both, variability accompanied by reduced levels of HDL cholesterol. Hypertriglyceridemia- Sr. triglycerides ≥ 150 mg/dl. Hypercholesterolemia- Sr. total cholesterol ≥ 200 mg/dl.
6. Hyperuricemia-Serum uric acid level > 7 mg/dl.
7. Smoker is defined as subject who has smoked at least 10 cigarettes per day for 6 months/more or the one who has smoked daily for more than 1 year or more irrespective of the number of cigarettes smoked per day.

Biochemical and radiological investigation: Serum uric acid level was measured with the Uricase method. All other biochemical measurement were done as per standard procedure. Plain CT (computed Tomography) or MRI (Magnetic resonance imaging) as per availability.

OBSERVATIONS AND RESULTS

Table 1: Age and sex wise distribution of cases of stroke.

Age Group	No. of cases	Male	Female
≤ 40	5	4	1
41-50	19	13	6
51-60	20	17	3
61-70	24	11	13
71-80	19	15	4
> 80	13	6	7
TOTAL	100	66	34

Mean age among male in the present study is 61.13 ± 14.16 years. Mean age among female in the present is 67 ± 15.12 years.

Table 2: Correlation of hypertension and SUA level in acute ischemic stroke

Sr. No.	Blood Pressure	Serum uric acid level				Total
		SUA ≤ 7 mg/dl		SUA > 7 mg/dl		
		N=63	N=37	N	%	
1	Normal BP	12	19.04	4	10.81	16
2	Pre HTN	11	17.46	1	2.70	12

	SBP 120 to 139 DBP 80 to 89 Stage 1 HTN	12	19.04	5	13.51	17
3	SBP 140 to 159 DBP 90 to 99 Stage 2 HTN	28	44.44	27	72.97	55
4	SBP >160 DBP >100					
5	Total	63	100	37	100	100

(Hypertensive Vs Nonhypertensive: Chi square test, $p = 0.0134$, $p < 0.05$, Significant) In 37 hyperuricemic patients, 1(2.7%) were prehypertensive, 5 (13.51%) were Stage 1 hypertensive, 27(72.97%) were Stage 2 hypertensive as compared to patients with normal uric acid where 60.71 % were hypertensive.

Table 3: Correlation of Diabetes with SUA in acute ischemic stroke.

Sr.No	Status	Serum uric acid level				Total
		SUA ≤ 7mg/dl		SUA > 7mg/dl		
		N=63		N=37		
		N	%	N	%	
1	Diabetic	17	26.98	12	32.43	29
2	Non Diabetic	46	73.01	25	67.56	71
3	Total	63	100	37	100	100

(Diabetic Vs Non diabetic, Chi square test, $p = 0.56$, $p < 0.05$, Not significant) Out of 37 patients with hyperuricemia in which 12(32.43%) patient were diabetic as compared with normal uric acid level 63 patient, in which 17(26.98%) were diabetic.

Table 4: Correlation of lipid profile and SUA level in acute ischemic stroke

Sr.No	Lipid Profile	Serum uric acid level				Total
		SUA ≤ 7mg/dl		SUA > 7mg/dl		
		N	%	N	%	
1	Normal	28	44.44	19	51.35	47
2	Dyslipidemia	35	55.55	18	48.64	53
3	Total	63	100	37	100	100

(Normal Vs Dyslipidemia, Chi square test, $P = 0.38$, $P < 0.05$, Not significant) The prevalence of dyslipidemia among hyperuricemic patients and patients with normal uric acid level is equal.

Table 5: Correlation of alcoholism and SUA level in acute ischemic stroke.

Sr. No	Status	Serum uric acid level				Total
		SUA ≤ 7mg/dl		SUA > 7mg/dl		
		N=63		N=37		
		N	%	N	%	
1	Alcoholic	21	33.33	8	21.62	29
2	Non alcoholic	42	66.67	29	78.38	71
3	Total	63	100	37	100	100

(Alcoholic Vs Nonalcoholic: $p = 0.21$, $p < 0.05$, Not Significant) Prevalence of alcoholism 29% in the present study, out of which 8 (21.62%) patients were hyperuricemic. All alcoholic were male patients and there was no correlation between alcoholism and serum uric acid level in our study.

Table 6: Correlation of Smoking and SUA in acute ischemic stroke.

Total	Status	Serum uric acid level				Total
		SUA ≤ 7mg/dl		SUA > 7mg/dl		
		N=63		N=37		
		N	%	N	%	
1	Smoker	21	33.33	12	32.43	33
2	Nonsmoker	42	66.67	25	67.57	67
3	Total	63	100	37	100	100

(Smoker Vs Non Smoker, Chi square test, $p = 0.92$, $p < 0.05$, Not Significant)

Out of 37 hyperuricemic patients 12(32.43%) patient were Smoker as compared to patients with normal uric acid level in which 21 (33.33%) patients were Smoker. There is no correlation between smoking's with serum uric acid level.

DISCUSSION

In our study we included total 100 patient with new onset acute ischemic stroke. Out of 100 patient 66% were male cases and 34% were female cases. Majority of cases 82(82%) were in the age group 41-80 years. 5 patients below the age of 40 and 13 patients above the age of 80 years. The prevalence of hyperuricemia was seen higher in male in study population. In our study out of 37 hyperuricemic patients 25 were male. In this study mean serum uric acid amongst males was 6.07 ± 1.67 mg/dl. And in females mean serum uric acid level was 5.92 ± 1.78 mg/dl. However the difference in serum uric acid level is not statistically significant (chi square test >0.05). Males generally have higher prevalence of hyperuricemia as compared to females. The difference may be because of uricosuric effect of estrogen in premenopausal women. But after menopause this difference of uric acid is not maintained. *KotwalSk et al 2015*⁵ There was considerable difference in uric acid between men and women ($p=0.01$). Hyperuricemia can be considered as a risk factor for acute stroke due to the high prevalence of hyperuricemia in patients with acute stroke.⁵ In our study the relationship between serum uric acid level and gender is insignificant this may be because of majority of women in present study were postmenopausal, as after menopause there is no difference in serum uric acid levels between men and women. In our study, we found that old age is a major risk factor for acute ischemic stroke. Study shown the prevalence of hyperuricemia in acute ischemic stroke in study population was 37%. Mean serum uric acid level was 6.02 ± 1.7 mg/dl. Out of 37 hyperuricemic patients in the present study 25 (67%) were above the age of 60 years. Out of 63 patients with normal uric acid 31(49%) were above the age of 60 years. Mean age of acute ischemic stroke in this present study is 63.14 ± 14.69 years. Average uric acid level above 60 years of age was 6.32 ± 2.75 mg/dl as compared to patient under or equal to the age of 60 years in whom mean serum uric acid level was 5.63 ± 1.68 mg/dl. Serum uric acid higher in older age group but we didn't get any statistically significant association between in serum uric acid and acute ischemic stroke. *Bansal et al*⁶ concluded that the prevalence of hyperuricemia of 30% in patients with acute ischemic stroke, with mean serum uric acid of 6.5 ± 1.19 mg/dl. They found the mean age of stroke as 59.40 ± 12.15 years. Our finding similar to the finding of *Bansal et al*⁶ In present study 72% patients were hypertensive and 12% patients were pre-hypertensive. Out of 37 hyperuricemic patients 32(86.48%) patients were hypertensive. Out of 72 hypertensive patients 40 (55.55%) patient have normal uric acid level. Mean uric acid in hypertensive patients is 6.14 ± 1.80 mg/dl and mean

uric acid in non-hypertensive is 5.74 ± 1.40 mg/dl. *Jiunn-Hoing Chen et al 2009*⁷ found that the prevalence of hypertension in approximately 32% of patient and shown a significant relationship in between hyperuricemia and hypertension in stroke patients. ($p < 0.05$) So our finding is consistent with the finding above mentioned, Out of 72 hypertensive patients 32 (44.44%) were hyperuricemic. We found higher incidence of hypertension 44% as compared to study done by *Jiunn-Hoing Chen et al 2009*⁷ possible due to measurement of BP after acute ischemic stroke which may increase secondary to intracranial tension. In our study, out of 100 stroke patients only 29 were diabetic and out of 37 hyperuricemic patients 12(32%) patients were diabetics as compared to patients with normal serum uric acid in whom only 17(27%) out of 63 patients were diabetic. Mean serum uric acid level among diabetic was 6.20 ± 1.66 mg/dl as compared to non-diabetic mean uric acid level was 5.94 ± 1.72 mg/dl. We didn't get any significant association between in diabetic vs non diabetic with normal and elevated serum uric acid level. ($p > 0.05$). *Taniguchi Y et al 2001*⁸ concluded that serum uric acid level was correlated with an increased risk for hypertension but not for Type 2 diabetes mellitus. *Cook DG et al 1988*⁹ concluded that there was positive relationship between blood sugar and serum uric acid concentrations up to about 8.0 mmol/l at higher levels of glucose, serum uric acid decreased. In insulin dependent diabetics and in those on oral hypoglycemic drugs, uric acid levels were significantly reduced. Our findings are similar to the study done by *Taniguchi Y et al 2001*⁸ In this study there was no significant difference in prevalence of dyslipidemia in patient with hyperuricemia and in patients with normal uric acid level. Among hyperuricemic patients group 18(48%) of patients were dyslipidemic as compared to patients with normal uric acid in which only 35(55%) of patients were dyslipidemic. Overall 53% patients were dyslipidemic. There was no statistically significant association found in between hyperuricemia and dyslipidemia. Mean serum uric acid level among dyslipidemic patient is 6.07 ± 1.65 mg/dl and among normal lipid profile patients, mean serum uric acid is 5.96 ± 1.77 mg/dl. *Chamorro et al 2002*¹⁰ showed insignificant relationship between dyslipidemia and serum uric acid in patients with acute ischemic stroke. They reported mean serum uric acid value of 5.21 ± 1.70 mg/dl amongst dyslipidemic patients as compared to 5.11 ± 1.81 mg/dl in nondyslipidemic patients. Our finding is similar to finding of *Chamorro et al 2002*¹⁰ We found overall prevalence of alcoholism in present study was 29% out of which 8(21%) patients were hyperuricemic. All alcoholics were male. There was no significant association in between hyperuricemia and alcoholism ($p > 0.05$). Mean serum uric

acid among alcoholic was 5.68 ± 1.61 mg/dl as compared to nonalcoholic in which it was 6.16 ± 1.73 mg/dl. *Tripathi VD et al*¹¹ Age, hypertension and alcoholism amongst males demonstrated statistically significant positive correlation with hyperuricemia in patient with acute ischemic stroke and hence they are considered to be the significant risk factors ($p < 0.05$). *Chamorro et al 2002*¹⁰ reported mean serum uric acid in alcoholics 5.46 ± 1.67 mg/dl vs. 5.10 ± 1.79 in non-alcoholics. They had found weak positive correlation in between alcohol and hyperuricemia in acute ischemic stroke. Our finding shown that mean uric acid levels are lower in alcoholics but we are not getting any statistically significant results may be due to fact that in our study women were exclusively non alcoholics or small study size. Another possible reason is the accuracy of the history regarding alcohol intake. Mean serum uric acid level amongst smokers was 6.03 ± 1.55 mg/dl as compared to non-smokers in which its value was 6.01 ± 1.79 mg/dl. Overall prevalence of smoking was 33%. Smoking was prevalent exclusively amongst men. Out of the 37 hyperuricemic patients, only 12 were smokers. There is no significant association between smoking and serum uric acid level. ($p > 0.05$) *Weir CJ et al 2003*¹² reported that relation between sr. uric acid level and smoking in acute ischemic stroke patients is not significant. *Chen JH et al 2009*⁷ done a cohort study and shown prevalence of smoking 37.7% amongst 15,784 acute ischemic stroke patients. So our finding consistent with the finding of *Weir CJ et al 2003*¹² and *Chen JH et al 2009*⁷.

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