ORIGINAL RESEARCH

Correlation of serum uric acid in subclinical target organ dysfunction in hypertensive population

[1]Dr. Bhavani MS, [2]Dr. Siddarth GR

[1]Senior Resident, Department of General Medicine, Bangalore Medical College and Research Institute, Bangalore, Karnataka, India
[2]Senior Resident, Department of Gastroenterology, St John's Medical College, Bangalore, Karnataka, India

Corresponding Author
Dr. Bhavani MS
Senior Resident, Department of General Medicine, Bangalore Medical College and Research Institute, Bangalore, Karnataka, India

Received: 02 September, 2023 Accepted: 25September, 2023

ABSTRACT
Serum uric acid (SUA) plays a role in the development of cardiovascular morbidly in the general population. The presence of subclinical hypertensive organ damage signals a condition of increased risk for cardiovascular, renal, morbidity and mortality. Thus, the search for left ventricular hypertrophy (LVH), carotid atherosclerosis, and microalbiminuria, which are likely to reflect both the severity of blood pressure load and other non-hemodynamic risk factors, is currently recommended as part of global risk assessment. The participants were clearly explained about the objectives and informed consent was obtained. All participants fulfilling the inclusion criteria were interviewed and detailed clinical examination was done. In this study 120 patients with recently diagnosed hypertension attending the outpatient clinic of our institution were studied. Albuminuria, Left ventricular mass index and carotid intima-media thickness were assessed for all patients. Uric acid levels correlated significantly with target organ damage indices. The correlation of uric acid was with LV mass index was the strongest when compared with that of microalbuminuria and carotid IMT. Serum uric acid levels positively correlated with number of target organs involved. However the direct relationship between uric acid and target organ damage was weakened by factors like dyslipidemia and degree of control of blood pressure, which also determined the target organ dysfunction. Serum uric acid levels positively correlated with number of target organs involved. The greater the number of organs involved the higher the uric acid levels.

Key words: Body mass index, blood pressure, common carotid artery, intima media thickness, left ventricular hypertrophy, serum uric acid, waist hip ratio

INTRODUCTION

Serum uric acid (SUA) plays a role in the development of cardiovascular morbidity in the general population, as well as in patients with hypertension,type II diabetes and cardiac or vascular diseases as illustrated by a number of studies.[1] A meta-analysis of data taken from 8 trials that were performed on hypertensive patients showed that each standard deviation (SD) increment in SUA entails an augmentation of cardiovascular risk that equals what is observed for similar changes in blood pressure or total cholesterol. However, the independent role of SUA as a risk factor has been undergoing debate for years. In fact, mild hyperuricemia is often a concomitant finding of obesity, lipid abnormalities, and insulin resistance, all of which are components of the metabolic syndrome (MS). Accordingly, insomestudies onwhite as wellasAsian populations, theirect relationship that is observed between uric acid and cardiovascular mortality weakens or disappears after adjusting for confounding factors.[2,3]

Several pathophysiological mechanisms linking SUA to cardiovascular damage at the cellular and tissue level have been proposed, including proliferation of vascular smooth muscle cells, stimulation of the inflammatory pathway, and possible prothrombotic effects mediated by platelet activation. In addition, uric acid has proved to be an excellent marker for tissue ischemia and endothelial dysfunction and it has been shown to play a role in thedevelopmentofatherosclerotic lesions.[4]

The presence of sub-clinical hypertensive organ damage signals a condition of increased risk for cardiovascular, renal, morbidity and mortality. Thus,

the search for left ventricular hypertrophy (LVH), carotid atherosclerosis, and microalbuminuria, which are likely to reflect both the severity of blood pressure load and other non-hemodynamicriskfactors,iscurrentlyrecommendedaspartofglobalriskassessment. Because the role of SUA in the development of cardiovascular disease

is receiving growing attention, a better understanding of its relationship with sub-clinical hypertensive target organ damage (TOD) may help clarify the pathophysiological mechanism(s) underlying this association.[5,6]

METHODOLOGY

STUDY DESIGN: Cross sectional study.

SAMPLE SIZE: 120 cases with Pearson's co-efficient of 0.001at 5% level of significance 80% power.

INCLUSION CRITERIA

- Age more than 18 years.
- Primary hypertensive individuals.

EXCLUSION CRITERIA

- Diabetes mellitus.
- Cardiac failure.
- Chronic kidney disease.
- Secondary hypertension.
- Patients with gout.
- Cerebrovascular accident.
- Patients with diagnosed target organ dysfunction.

After obtaining ethical clearance and approval from the Institutional Ethics Committee, Written informed consent was taken from patients. Clinical examination and investigations were done and Data was collected using a proforma. For all patients with hypertension ECG, 2D echo, carotid vessel Doppler, Fundus examination and urine routine was done.

RESULTS

Table 1: Age distribution of study population

Age group(years)	Numbers(Percentage)	Distribution (years)
<30	0	33-68
30-39	11 (9%)	
40-49	65 (54%)	
50-59	32 (27%)	
60-69	12 (10%)	
>70	0	
Total	120 (100%)	

The mean age in our study of 120 patients was 48 and the standard deviation was 7.8. Majority of patients were in age group between 40 and 49 years which is an economically productive age group.

Table 2: Correlation of components of metabolic syndrome with uric acid and target organ damage

Characteristic	Uric acid (correlation coefficient/p value)	Microalbuminuria (correlation coefficient/p value)	LV mass index (correlation coefficient/p value)	Carotid IMT (correlation coefficient/p value)
BMI	0.044 (p = 0.632)	0.044 (p = 0.631)	-0.001 (p = 0.993)	0.006 (p = 0.946)
Waist circumference	-0.067 (p = 0.465)	0.016 (p = 0.860)	0.048 (p = 0.605)	-0.039 (p = 0.672)
Total Cholesterol	-0.006 (p = 0.948)	-0.087 (p = 0.342)	0.069 (p = 0.452)	-0.035 (p =0.702)
HDL cholesterol	0.039 (p = 0.671)	0.140 (p = 0.128)	0.045 (p = 0.624)	0.162 (p =0.078)

Therewasnosignificantcorrelationbetweencomponents ofmetabolic syndrome with uric acid and target organ damage.

Table 3: Correlation of waist circumference with uric acid levels

Characteristic	Waist circumference	N	Mean uric acid levels	SD	t- test
Uric acid	Normal	59	5.7683	1.495	p <0.0001
	Abnormal	61	5.3398	1.763	

Correlation of waist:hip ratio with uric acid p-value = 0.27897.

Table 4: Correlation of parameters of target organ damage with uric acid levels

Characteristic	LV mass index	N	Mean uric acid levels	SD	t-test
Uric acid	Normal	55	4.3902	1.086	t=9.656 p<0.0001

	Abnormal	65	6.5455	1.358	
Characteristic	**Carotid IMT**	**N**	**Mean uric acid levels**	**SD**	**t-test**
Uric acid	Normal	61	4.6225	1.282	t=7.767 p<0.0001
	Abnormal	59	6.5246	1.395	
Characteristic	**Microalbuminuria**	**N**	**Mean uric acid levels**	**SD**	**t-test**
Uric acid	Normal	72	5.2665	1.575	t=2.406 p=0.018
	Abnormal	48	5.9944	1.654	

Table 5: Correlation of uric acid levels with number of target organs involved

Number of target organs involved	N	Mean uric acid levels	SD
0	34	4.3332	1.0952
1	35	4.9702	1.3208
2	28	6.5075	1.4680
3	23	7.1052	0.9451

The number of target organs involved increased proportionally with increase in serum uric acid levels.

DISCUSSION

Table 6: Correlation of uric acid with target organ damage

Parameters	Study done by Viazzi F *et al.* [7]	Study done by Maloberti A *et al.* [8]	Study done by Oforiet *al.* [9]	Present study
Age	Not significant	Not significant	p = 0.115	p = 0.81
Gender	NA	NA	NA	p = 0.144
Total cholesterol	p = 0.12	NA	p = 0.316	p = 0.948
HDL cholesterol	p = 0.02	p < 0.001	p = 0.146	p = 0.671
Microalbuminuria	p = 0.02	p < 0.001	p <0.0001	p = 0.018
LV mass index	p = 0.002	Not significant	p <0.0001	p <0.0001
Carotid IMT	p = 0.013	NA	NA	p <0.0001
Numer of target organs involved	p = 0.02	NA	p = 0.017	p = 0.001

Serum uric acid levels were correlated with various variables that affected the target organ damage in hypertensive population. Age and sex did not have any significant effect on the uric acid levels. While HDL cholesterol had a negative correlation with uric acid levels it was not found to be statistically significant. In this study serum uric acid correlated significantly with pre-clinical target organ dysfunction, i.e. microalbuminuria, LV mass index and carotid intima media thickness. These findings were similar to the above compared studies, which had also reported a strong association between uric acid levels and pre-clinical target organ dysfunction.[10]

CONCLUSION

Serum uric acid levels positively correlated with number of target organs involved. However the direct relationship between uric acid and target organ damage was weakened by factors like dyslipidemia and degree of control of blood pressure, which also determined the target organ dysfunction.

REFERENCES

1. Fang J, Alderman MH. Serum uric acid and cardiovascular mortality: The NHANES I epidemiologic follow-up study, 1971-1992. National Health and Nutrition Examination Survey. J Am Med Assoc. 2000 May 10;283(18):2404-10.
2. Puddu PE, Lanti M, Menotti A, Mancini M, Zanchetti A, Cirillo M, *et al*. Serum uric acid for short-term prediction of cardiovascular disease incidence in the Gubbio population Study. ActaCardiol. 2001;56:243-51.
3. Liese AD, Hense HW, Lowel H, Doring A, Tietze M, Keil U. Association of serum uric acid with all-cause and cardiovascular disease mortality and incident myocardial infarction in the MONICA Augsburg cohort. World Health Organization Monitoring Trends and Determinants in Cardiovascular Diseases. Epidemiology. 1999;10:391-7.
4. Niskanen LK, Laaksonen DE, Nyyssonen K, Alfthan G, Lakka HM, Lakka TA, *et al*. Uric acid level as a risk factor for cardiovascular and all-cause mortality in middle-aged men: a prospective cohort study. Arch Intern Med. 2004;164:1546-51.
5. Alderman MH, Cohen H, Madhavan S, Kivlighn S. Serum uric acid and cardiovascular events in successfully treated hypertensive patients. Hypertension. 1999;34:144-50.
6. Verdecchia P, Schillaci G, Reboldi G, Santeusanio F, Porcellati C, Brunetti. Relation between serum uric acid and risk of cardiovascular disease in essential hypertension. The PIUMA study. Hypertension. 2000;36:1072-8.
7. Viazzi F, Leoncini G, Ratto E, Vaccaro V, Parodi A, Falqui V, *et al*. Serum uric acid as a marker of target organ damage in primary hypertension. American Journal of Hypertension. 2005;18(5):A1.

8. Maloberti A, Maggioni S, Occhi L, Triglione N, Panzeri F, Nava S, *et al*. Sex-related relationships between uric acid and target organ damage in hypertension. The Journal of Clinical Hypertension.2017;20(1):193-200.
9. Ofori SN, Odia OJ. Serum uric acid and target organ damage in essential hypertension. VascHealthRisk Manag. 2014 May 2;10:253-61.
10. Lewington S, Clarke R, Qizilbash N, Peto R, Collins R. Age-specific relevance ofusual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. Lancet 2002;360:1903-13.