

Evaluation of Rol of Serum Uric Acid Levels in Cases of Essential Hypertension

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ABSTRACT

Introduction: The etiological factors associated with hypertension is difficult to predict because hypertension results from a complex interaction of genes and environmental factors. Previous researches have already studied the role of serum uric acid in development of hypertension. Serum uric acid (UA) levels were demonstrated to be an independent predictor for developing hypertension.

Material and methods: It was a hospital based cross sectional analytical study. 196 cases of hypertension who attended the out-patient and in-patient at the department of Medicine were evaluated for Serum Uric Acid levels.

Results: The mean SUA levels in Stage I and Stage II hypertensive patients in Cases Group were 4.99±1.29 and 6.64±1.75 mg/dl respectively.

Conclusions: There is definite relation in SUA levels between hypertensive patients and normotensive patients and SUA levels have direct relation to the duration and severity of hypertension.

Keywords: Hypertension, Serum Uric Acid, Hyperuricemia, Cardiovascular Disorders

INTRODUCTION

Hypertension is the emerging public health problem of adult population across the globe, affecting one in every four individuals.¹ The etiological factors associated with hypertension is difficult to predict because hypertension results from a complex interaction of genes and environmental factors.¹ Previous researches have already studied the role of serum uric acid in development of hypertension. The reasonable mechanism for the development of hypertension in hyperuricemia includes: (a) uric acid induced activation of renin-angiotensin system and action on glomerular apparatus.^{2,3} (b) increased insulin resistance and hyperinsulinaemia, causing decreases excretion of uric acid, sodium, potassium from renal tubules.^{4,5} and (c) uric acid action in proliferation of vascular smooth muscle/endothelial dysfunction with decrease nitric acid production.^{7,8} However, there are numerous confounding factors including metabolic syndrome, diabetes mellitus, chronic kidney disease, obesity, alcohol consumption, salt intake, fluid volume status etc. in the association of hyperuricemia and hypertension. Frederick Mohamed first time reported that serum uric acid was associated with raised blood pressure in 1870s.⁹ The mechanism(s) by which UA may engender organ damage is still incompletely understood, but there is increasing evidence that endothelial dysfunction is a fundamental mechanism whereby this substance may affect cardiovascular and renal function and structure.¹⁰ Serum uric acid was proved to be

an predictor for hypertension by various authors in their researches.¹¹⁻¹³ Various mechanisms such as inflammation and smooth muscle cell proliferation in kidneys and activation of renin-angiotensin-aldosterone system play a role in development of hypertension through involvement of uric acid.¹⁴⁻¹⁶

Though we have enough studies which proves role of uric acid in development of hypertension, Studies regarding same in Indian scenario are lacking. Hence the present study was done at our tertiary care centre to assess the role of raised serum uric acid levels in development of hypertension

MATERIAL AND METHODS

It was a hospital based cross sectional analytical study. Considering a confidence level of 95% and confidence interval of 7 the number of patients in our study to achieve statistical significance is 196. This was calculated by Survey System November 2017. Hence the present study was conducted among 200 patients (100 study group and 100 control group) who attended the out-patient and in-patient at the department of Medicine were evaluated for Serum Uric Acid levels. The study was conducted over a period of 24 months starting from December 2015 to November 2017. All patients above 18 years of age, who were diagnosed hypertensive according to JNC-VII and VIII criteria; patients having Diabetes Mellitus, Ischaemic Heart Disease, All cases of secondary hypertension, Clinical Findings of gout or extra-articular manifestations of hyperuricemia, Obesity (body weight exceeding 25% of body weight), H/o alcohol abuse and red meat eaters, H/o drugs known to cause hyperuricemia, e.g. thiazide diuretics, H/o Renal disease H/o pre-eclampsic toxemia were excluded from the study. Cases with no history of hypertension or conditions associated with raised serum uric acid levels were selected as controls after matching for age and sex.

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How to cite this article: Kothia Divyen, Aundhakar SC, Sutariya Nirav L, Ratan Vartika, Patel Hardik. Evaluation of rol of serum uric acid levels in cases of essential hypertension. International Journal of Contemporary Medical Research 2018;5(5):E18-E21.

DOI: <http://dx.doi.org/10.21276/ijcmr.2018.5.5.11>

All the study subjects were evaluated for their clinical presentation and examinations. Various laboratory investigations were also carried out wherever necessary.

STATISTICAL ANALYSIS

Quantitative data is presented with the help of Mean and Standard deviation. Comparison among the study groups is done with the help of unpaired t test as per results of normality test. Qualitative data is presented with the help of frequency and percentage table. Association among the study groups is assessed with the help of Fisher test, student 't' test and Chi-Square test.

RESULTS

The present study was a cross sectional study conducted in hospital among 200 cases in order to determine role of serum uric acid in development of hypertension. The patients were divided into following two groups of 100 patients above 18 years of age, who were diagnosed hypertensive according to JNC-VII and VIII criteria were included as cases and 100 patients with no history of hypertension or conditions associated with raised serum uric acid levels were selected as controls after matching for age and sex.

Majority of the patients in Cases Group were in the age group of 51-60 years (34%) followed by 61-70 years (20%), 41-50 years (19%), 31-40 (13%), 71-80 years (6%), 20-30 years (5%) and 81-90 years (3%). We found 54.6 years as the average age of hypertensive cases (study group) (Table 1). Majority of the patients in Controls Group were in the age group of 31-40 years (24%) followed by 41-50 years (19%), 61-70 years (19%), 51-60 (14%), 20-30 years (12%) and 71-80 years (12%). In the control group, the mean age of subjects was found to be 49.6 years. There was significant difference between the groups as per Student t-test ($p=0.003$) (Table 1). There was male preponderance in both the groups (63% and 65% respectively) while female patients constituted 37% and 35% of groups. There was no significant difference between the groups as per Chi-Square test ($p>0.05$) (Table 2). The mean SUA level in Cases Group was 6.18 ± 1.79 mg/dl which was significantly higher as compared to mean SUA levels in Controls Group (5.60 ± 1.83 mg/dl) as per Student t-test ($p<0.05$) (Table 3). The mean SUA levels in Stage I and Stage II hypertensive patients in Cases Group were 4.99 ± 1.29 and 6.64 ± 1.75 mg/dl respectively. This difference is statistically significantly as per Student t-test ($p<0.05$) (Table 4). The mean SUA levels in <5 years and >5 years

Age (years)	Cases		Controls		Total
	N	%	N	%	
< 40	18	18%	36	36%	54
41-60	53	53%	33	33%	86
61-80	26	26%	31	31%	67
> 80	3	3%	0	-	3
Total	100	100%	100	100%	200
Mean \pm SD	54.6 \pm 13.27 years		49.6 \pm 16.71 years		52.1 \pm 15.25 years
Chi-Square Value (P-value)	19.512 (0.003)				

Table-1: Distribution of study participants according to age

Gender	Cases		Controls		Total
	N	%	N	%	
Male	63	63%	65	65%	128
Female	37	37%	35	35%	72
Total	100	100%	100	100%	200
Chi-Square Value (P-value)	0.087 (0.768)				

Table-2: Distribution of participants according to gender

	Group	N	Mean	SD	t-value	p-value
SUA	Cases	100	6.18	1.79	2.23	0.027
	Controls	100	5.60	1.83		

Table-3: Serum Uric Acid (SUA) levels of patients

	Stage of Hypertension	N	Mean	SD	t-value	p-value
SUA	Stage-I	28	4.99	1.288	-4.535	<0.001
	Stage-II	72	6.64	1.751		

Table-4: Association of serum uric acid (SUA) levels and stage of hypertension in cases group

	Duration of Hypertension	N	Mean	SD	t-value	p-value
SUA levels	<5 years	46	5.29	1.66	-5.135	<0.001
	>5 years	54	6.93	1.55		

Table-5: Association of serum uric acid (SUA) levels and duration of hypertension in cases group

hypertensive patients in Cases Group were 5.29 ± 1.66 and 6.93 ± 1.55 mg/dl respectively. This difference is statistically significantly as per Student t-test ($p < 0.05$) (Table 5).

DISCUSSION

This hospital based cross sectional analytical study was carried out among 200 cases attending outpatient or indoor cases in department of medicine in a tertiary healthcare institute, while 100 were the other cases without hypertension or any association with raised serum uric acid levels.

In the given study we found that majority of hypertensive cases belonged to age group of 40-60 years followed by 60 to 80 years with male preponderance. Lee JJ et al¹⁷ in their study found that majority of cases belonged to age group of 40-50 years.

In the present study we measured serum uric acid levels of cases and controls in order to find any association between stages and course of hypertension and serum uric acid levels. We found that the mean serum uric acid levels (SUA) level in Cases Group was 6.18 ± 1.79 mg/dl which was significantly higher as compared to mean SUA levels in Controls Group (5.60 ± 1.83 mg/dl) as per Student t-test ($p < 0.05$). Neki NS et al¹⁸ (2015) case control study observed that the value of mean SUA (serum uric acid) was 5.8 mg% significantly more in cases than that was in control group 4.4mg%. Shrivastav C et al¹⁹ (2016) hospital based case control study investigating the existence of an association between serum uric acid and essential hypertension reported. Among Control, Pre-hypertensive and hypertensive groups, mean serum uric acid levels were 4.91 ± 0.88 mg/dl, 5.89 ± 0.97 and 6.56 ± 0.64 mg/d.

In our study, the mean SUA levels in Stage I and Stage II hypertensive patients in Cases Group were 4.99 ± 1.29 and 6.64 ± 1.75 mg/dl respectively. This difference is statistically significantly as per Student t-test ($p < 0.05$). Vakili A et al²⁰ study on relation between severity of Hypertension to serum uric acid level reported 28 patient were in stage 1 HTN out of which 21 number (75%) of patients had elevated SUA level, while 72 patients were in stage 2 HTN out of which 44 (6.1%) of patients had elevated SUA level.

In the present study, the mean SUA levels in < 5 years and > 5 years hypertensive patients in Cases Group were 5.29 ± 1.66 and 6.93 ± 1.55 mg/dl respectively. This difference is statistically significantly as per Student t-test ($p < 0.05$). Lee JJ et al¹⁷ in their study found association between hyperuricemia and hypertension with odds ratio of 1.25 (in men less than 40 years and women between 40-50 years), whereas among women of less than 40 years of age group, the odds ratio was found to be 2.6. Neki NS et al¹⁸ case control study reported value rises with the duration and the severity of hypertension. It is evident by mean values of SUA, which are 5.37 mg% and 6.39mg% respectively in stage-1 and stage-2 HTN and 4.94 mg% and 6.93 mg% in < 5 years and > 5 years of Hypertension. Vakili A et al²⁰ study on relation between severity of Hypertension to serum uric acid level found that there is definite relation in SUA levels between hypertensive patients and normotensive

patients and the serum levels of Serum uric acid were found directly proportional to the duration and severity of hypertension. Hence the possibility of serum uric acid acting by the production of free radicals and causing oxidative stress leading to hypertension and whether the duration and severity of hypertension lead to renal dysfunction in the form of nephrosclerosis leading to higher levels of serum uric acid has to be considered as various other studies have also show to have a positive relation in the SUA levels and hypertension.

CONCLUSIONS

There is definite relation in SUA levels between hypertensive patients and normotensive patients and SUA levels have direct relation to the duration and severity of hypertension. Based on the study carried out it is concluded that Serum uric acid levels can be used as a determinant for duration and severity of hypertension. Our study demonstrated that serum uric acid levels can be used to correlate with severity of hypertension among newly diagnosed hypertensive patients than pre-hypertensive cases. our study observed raised serum uric acid levels among newly diagnosed hypertensive patients.

In our study, we concluded that the hypertensive patients are often associated with raised serum uric acid levels as comorbidity though they were not on the medication. Further researches needs to be carried out in the context of lowering serum uric acid levels for management of hypertension and its monitoring in order to alter its course.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 19-04-2018; **Accepted:** 21-05-2018; **Published:** 02-06-2018