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A STUDY ON A COMPARATIVE ANALYSIS ON SERUMURIC ACID LEVELS IN THE SPECTRA OF HYPERTENSION

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ABSTRACT: Introduction: Hyperuricemia in prehypertension & hypertension may be causal or a consequence. Hyperuricemia is found to stimulate smooth muscles in vessel wall and induce endothelial dysfunction which plays a critical role in pathogenesis of hypertension. Hypertension can, in turn, induce renal dysfunction resulting in reduction in GFR and renal urate excretion. Though studies show elevated uric acid levels in both the Prehypertensive and hypertensive groups, studies analysing the correlation of uric acid levels among the Prehypertensive and hypertensive groups are few. **Aim of the study** 1. To evaluate for the presence of Asymptomatic Hyperuricemia in Normotensive, Pre hypertensive and Hypertensive Population 2. To compare qualitatively and quantitatively, the serum Uric Acid levels in various Hypertensive classification groups. **Methods & Materials**: This was a prospective observational study done in SV Medical College Hospital in 300 patients selected randomly from outpatient clinics in the Department of Medicine, SVMC. The subjects were evaluated for presence of Hypertension and were classified as per JNC VII Recommendation (Normotensive, Pre- Hypertensive, Hypertensive- stage I & II). Other details such as presence of hypertension and diabetes mellitus were noted. Anthropometric measurements were taken for them and BMI was calculated. Serum Uric Acid, along with fasting blood glucose and serum cholesterol was estimated in these patients. All the data were collected on a proforma prepared for this study and was analysed. Hyperuricemia is taken as S. Uric Acid≥ 6.8mg/dl. **Conclusion:** The findings in my study reinstate the analyses done in western world on the correlation between uric acid and hypertension. All hypertensive groups have elevated uric acid levels. The strongest correlation among the hypertensive groups is found in stage II Hypertension. It is also seen that as the stage of hypertension increases, the mean uric acid levels also increase. There is a sudden rise in the mean values from stage I to stage II. This suggests that there might be a significant role of uric acid in pathophysiology of complications of hypertension as it is well established that higher grades of hypertension are associated with greater degree of end organ damage. Asymptomatic hyperuricemia (S. Uric acid≥ 6.8 mg/dl) is significantly associated with all factors making up the components of metabolic syndrome, consistent with similar studies done in this regard. The correlation between serum uric acid levels and hypertension is an important paradigm in the identification of multiple factors involved in the pathophysiology of hypertension. The need for this comes from the fact that hypertension is a major morbidity and mortality factor which is becoming increasingly prevalent in our country. As further studies are in progress, there may come a time when drugs lowering uric acid may play a role in primary prevention of hypertension or secondary prevention of complications.

Keywords: Hyperuricemia, Hypertension, Pre Hypertension, Normotension

INTRODUCTION

Hyperuricemia was first discovered by Alfred Baring Garrod [1], who showed that in patients with gout, there was a high level of uric acid content. Some researchers consider hyperuricemia as a positive factor, especially due to the observation that uric acid can function as an antioxidant that can block superoxide, peroxynitrite, and iron-catalyzed oxidation reactions. However, recent studies in the western world have shown asymptomatic hyperuricemia to be associated with poor outcome in those with cardiovascular disease

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and those with renal insufficiency [2]. Uric acid levels correlate with pre hypertension, hypertension and with other components of metabolic syndrome.

Hyperuricemia in pre hypertension & hypertension may be causal or a consequence. Hyperuricemia is found to stimulate smooth muscles in vessel wall and induce endothelial dysfunction which plays a critical role in pathogenesis of hypertension. Hypertension can, in turn, induce renal dysfunction resulting in reduction in GFR and renal urate excretion. Though studies show elevated uric acid levels in both the Pre hypertensive and hypertensive groups, studies analysing the correlation of uric acid levels among the Pre hypertensive and hypertensive groups are few. Also a quantitative correlation may act as a marker of severity of endothelial dysfunction in these subjects [3]. Hence studies are required to quantitate the levels of uric acid among both Prehypertensive and hypertensive groups (with stage I & II as sub groups) and see if higher levels of uric acid arefound as BP levels become higher.

AIM OF THE STUDY

1. To evaluate for the presence of Asymptomatic Hyperuricemia in Normotensive, Pre hypertensive and Hypertensive Population

2. To compare qualitatively and quantitatively, the serum Uric Acid levels in various Hypertensive classification groups.

METHODS & MATERIALS

This was a prospective observational study done in SV Medical College Hospital in 300 patients selected randomly from outpatient clinics in the Department of Medicine, SVMC.

Inclusion Criteria: Normotensive, Pre Hypertensive and Hypertensive patients

Exclusion Criteria: Known cases of Hyperuricemia, Gout, Leukaemia, chemotherapy, Renal failure

The subjects were evaluated for presence of Hypertension and were classified as per JNC VII Recommendation (Normotensive, Pre- Hypertensive, Hypertensive- stage I & II). Other details such as presence of hypertension and diabetes mellitus were noted. Anthropometric measurements were taken for them and BMI was calculated. Serum Uric Acid, along with fasting blood glucose and serum cholesterol was estimated in these patients. All the data were collected on a proforma prepared for this study and was analysed. Hyperuricemia is taken as S. Uric Acid≥ 6.8mg/dl.

Statistical analysis

Mean values of all parameters in subgroups were calculated by independent sample-t-test. To compare the distributions of dichotomousdata viz .gender, presence of hypertension or diabetes and hyperuricemia, Chi-square test was used. Association between Hypertension and hyperuricemia was assessed by logistic regression model. Potential confounders were adjusted for. Pearson correlations were applied to evaluate the correlation between Hypertension and age, sex, height, weight, BMI, blood sugar, cholesterol & uric acid levels. All statistical analyseswere performed using the SPSS package .A p-value of less than 0.05 was considered to be statistically significant.

RESULT & ANALYSIS

STAGE OF HT	NO OF SUBJECTS
NORMOTENSION	75
PREHYPERTENSION	25
STAGE I HYPERTENSION	33
STAGE II HYPERTENSION	17

Table 1: Distribution of Subjects According to Hypertensive Groups

AGE GROUP(NO)	Number of Patients
30- 39(1)	39 (26%)
40-49(2)	52 (34.7%)
≥50(3)	59 (39.3%)

Table 2 : Distribution in Age Groups

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	NUMBER	MEAN AGE
NORMOTENSIVE	75	43
HYPERTENSIVE	75	49.31
p= 0.000 statistically significant		

Table 3 : Mean Age

Hypertensive group	Number	Mean Age
Normotension	75	43.00
Pre Hypertension	25	50.40
Stage I Hypertension	33	49.91
Stage II Hypertension	17	46.53
Total	**150**	**46.15**

Table 4 : Mean Age among Hypertensive Groups

	MALES	FEMALES
NORMOTENSIVE	41	34
HYPERTENSIVE	30	45
p=0.072 not statistically significant		

Table 5: Sex Distribution

		No of subjects	Mean
WEIGHT	Hypertensive	75	66.00
	Non- Hypertensive	75	61.79
HEIGHT	Hypertensive	75	164.29
	Non- Hypertensive	75	163.25
p= 0.028 statistically significant			

Table 6 : Mean Height and Weight

	No of subjects	Mean BMI
HYPERTENSIVE	75	24.26
NON HYPERTENSIVES	75	22.57
P=0.000 statistically significant		

Table 7 : Mean BMI

	NO OF SUBJECTS	MEAN FBS
HYPERTENSIVE	75	134.60
NORMOTENSIVE	75	117.97
p= 0.000 statistically significant		

Table 8 : Mean FBS

	NO OF SUBJECTS	MEAN CHOLESTEROL
HYPERTENSIVE	75	191.05
NORMOTENSIVE	75	156.80
p= 0.000 statistically significant		

Table 9 : Mean Cholesterol Levels

	NO OF SUBJECTS	MEAN CHOLESTEROL
NORMOTENSION	75	156.80
PRE HYPERTENSION	25	179.84
STAGE I HYPERTENSION	33	172.61
STAGE II HYPERTENSION	17	243.35

Table 10 : Mean Serum Cholesterol levels among Hypertensive Groups

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	NO	MEAN	SD	STANDARD ERROR OF MEAN
HYPERTENSIVE	75	5.55	2.014	0.233
NORMOTENSIVE	75	4.09	1.036	0.120
p= 0.000 statistically significant				

Table 11 : Mean Serum Uric Acid

	Levene's Test for Equality of Variances	t-test for Equality of Means
Significance(p)	0.000	0.000

Table 12 : Test of Significance

	MEAN S. URIC ACID
NORMOTENSION	4.09
PRE HYPERTENSION	4.86
STAGE I HYPERTENSION	5.08
STAGE II HYPERTENSION	7.46

Table 13 : Mean Serum Uric Acid among Hypertensive Groups

Hyperuricemia	Frequency	Percentage
Absent	128	85.3
Present	22	14.7

Table 14 : Frequency of Hyperuricemia

	UA< 6.8		UA≥6.8	
	NUMBER	PERCENT	NUMBER	PERCENT
NORMOTENSION	74	57.8	1	4.5
PRE HYPERTENSION	23	18	2	9.1
STAGE I HYPERTENSION	27	21.1	6	27.3
STAGE II HYPERTENSION	4	3.1	13	59.1
p= 0.000 statistically significant				

		NO OF SUBJECTS	MEAN BP
SBP	HYPERURICEMIA	22	156.77
	NORMAL	128	122.87
DBP	HYPERURICEMIA	22	97.09
	NORMAL	128	81.91
p= 0.000 statistically significant			

Table 15 : Distribution of Hyperuricemia among Hypertensive Groups

Table 16 : Mean SBP and DBP among Hyperuricemic Subjects

		NO OF SUBJECTS	Mean
WEIGHT	HYPERURICEMIA	22	70.91
	NORMAL	128	62.69
HEIGHT	HYPERURICEMIA	22	163.73
	NORMAL	128	163.78
p=0.002 statistically significant			

	NO OF SUBJECTS	MEAN BMI
HYPERURICEMIA	22	26.25
NORMAL	128	22.93
p= 0.000 statistically significant		

Table 17: Mean Weight and Height among Hyperuricemic Subjects

Table 18 : Mean BMI among Hyperuricemic Subjects

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DISCUSSION

In the study, 300 subjects attending the outpatient department of our hospital for minor ailments were screened. The study group included males and females (47.3% & 52.3%) respectively. The age of the study group was between 30 & 60 yrs, with a distribution of 39.3%, 34.7% & 26.0% when grouped for a decade. Among the subjects, 75 were found to be normotensive while the rest had an abnormal BP. The distribution among the Pre hypertensive, Stage I Hypertensive & Stage II Hypertensive groups was 17% 22% & 11% respectively.

The mean age of the study group was 46.15 years. The mean age distribution among the normotensive, Prehypertensive, Stage I Hypertensive & Stage II Hypertensives was 43, 50.4, 49.9 & 46.53 years. Using ANOVA, the age distribution was found to be statistically significant meaning that age correlates with level of blood pressure with normotensive being youngerthan hypertensives. However, the study also throws an interestingobservation that among the hypertensive population, stage II Hypertensives seem to be younger than for lesser levels of hypertension, in the study group. This is a dangerous finding and further studies are needed if this trend exists in the population at large or is just an incidental finding in this study. There was no correlation found between the sex groups and the development of hypertension.

Analysis of the anthropometric measurements revealed that hypertensives tend to be obese compared to normotensives (66 & 61.29 kg respectively) and this was also statistically significant (p=0.028). Using post hoc analysis, this correlation was found to apply best on comparison of weight between the Normotension and Stage II Hypertension groups, andnot among the other groups. However no correlation was made out between height and BP levels. On an expected note, the BMI also was found to be higher in hypertensives (p=0.00). The mean BMI level was 24.26 comparedto 22.57 in the normotensive subjects. On post hoc analysis, this correlation was best appreciated between all the hypertensive groups and Stage II hypertensives i.e. these subjects were associated with very high BMI (27.26).

Among the other biochemical parameters, both FBS and serum cholesterol levels were much higher in the hypertensive group (134.60 vs 117.97 & 191.05 vs 156.80 respectively). In this correlation, multiple comparisons among the hypertensive groups were done. With regards to FBS, the difference in the value was significant between stage II hypertension (mean FBS- 168.3 mg/dl) and other groups. With regards to serum cholesterol, a similar relationship existed (S. Cholesterol in Stage II Hypertension=243.34 mg/dl). In addition, there was also significant difference between the cholesterol levels in normotensive and prehypertension groups. The major parameter in this study is S. Uric acid & Hyperuricemia. By levene's test & independent t- test, the relation between uric acid levels and hypertension was found to be statistically significant (p=0.00) i.e. with increasing BP, the mean serum uric acid level also increases(5.55 mg/dl among hypertensives vs 4.09 mg/dl in normotensive). The mean serum uric acid level among the hypertensive groups in increasing levels of BP is 4.09, 4.86, 5.08 & 7.46(in mg/dl). On post hoc multiple comparative analyses among the hypertensive groups, there was an elevation in uric acid levels in Stage I & II hypertensives which was statistically significant(p=0.001 & 0.000 respectively. The higher level of serum uric acid levels in the Stage II hypertension was statistically significant across all groups.

Hyperuricemia was seen in subjects out of the 300 (14.7%) andwas distributed with increasing frequency with increasing BP, with almost 60% of them in Stage II Hypertension. Using Pearson's chi- square test, the relation between hyperuricemia and hypertension was found to be statistically significant (p=0.000). Hyperuricemia was associated with higher mean SBP (156 mm Hg) & DBP (97 mm Hg), values that almostnear the levels of Stage II Hypertension. With regards to anthropometric measure, the correlation between hyperuricemia and weight was statistically significant (p=0.002). The average Weight in the hyperuricemic subjects was 70.79 kg compared to 62.69 kg in the normal group. For Height, the correlation was not statistically significant (p=0.9> 0.05). The correlation between hyperuricemia and BMI, was statistically significant (p=0.000). The average BMI in the hyperuricemic subjects was 26.25 kg, compared to 22.93 kg in normal subjects.

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These results are consistent with studies by **Cannon et al**[4] whose studies had analysed the correlation between uric acid and level of hypertension [(54)]. Their studies have shown that hyperuricemia was observed in 25% of hypertensive subjects who weren't treated, half of those on treatment, and almost all of those with malignant hypertension.

Another study by **Bulpitt et al** [5] reported that elevated levels of uric acid were observed in half of hypertensive subjects at the national level. The data from the First National Health and Nutrition Examination Survey (NHANES I) from NHANES I Epidemiologic Follow-up Study (NHEFS) were analysed in a landmark trial by **Fang et al** [6]. Around 6000 subjects were studied and the correlation between serum uric acid and cardiovascular risk factors were analysed. Our results were consistent with the findings in their study which showed a significant association between uric acid and factors like blood sugar, serum cholesterol and BMI.

CONCLUSION

The findings in my study reinstate the analyses done in western world on the correlation between uric acid and hypertension. All hypertensive groups have elevated uric acid levels. The strongest correlation among the hypertensive groups is found in stage II Hypertension. It is also seen that as the stage of hypertension increases, the mean uric acid levels also increase. There is a sudden rise in the mean values from stage I to stage II. This suggests that there might be a significant role of uric acid in pathophysiology of complications of hypertension as it is well established that higher grades of hypertension are associated with greater degree of end organ damage. Asymptomatic hyperuricemia (S. Uric acid≥ 6.8 mg/dl) is significantly associated with all factors making up the components of metabolic syndrome, consistent with similar studies done in this regard. The correlation between serum uric acid levels and hypertension is an important paradigm in the identification of multiple factors involved in the pathophysiology of hypertension. The need for this comes from the fact that hypertension is a major morbidity and mortality factor which is becoming increasingly prevalent in our country. As further studies are in progress, there may come a time when drugs lowering uric acid may play a role in primary prevention of hypertension or secondary prevention of complications.

References:

1. Garrod AB. The nature and treatment of gout and rheumatic gout. 2nded. London: Walton and Maberly; 1863.

2. Asymptomatic hyperuricemia: perhaps not so benign? Neogi T; J Rheumatol. 2008 May; 35(5):734-7.

3. Uric Acid and Endothelial Dysfunction in Essential Hypertension. Carmine Zoccali et al. J Am Soc Nephrol 17: 1466 –1471, 2006.

4. Cannon PJ, Stason WB, Demartini FE, Sommers SC, Laragh JH. Hyper- uricemia in primary and renal hypertension. N Engl J Med. 1966; 275: 457– 464.

5. Bulpitt CJ. Serum uric acid in hypertensive subjects. Brit Heart J.1975; 37:1210 –1215.

6. Serum uric acid and cardiovascular mortality the NHANES I epidemiologic follow-up study, 1971-1992. National Health and Nutrition Examination Survey. Fang J, Alderman MH. JAMA. 2000 May 10; 283(18):2404-10