

**Research Article****Evaluation of serum uric acid in essential hypertension presenting at THQ  
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and <sup>3</sup>Omaima Masood**<sup>1</sup>Medical Officer THQ Hospital Shakargarh  
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<sup>3</sup>House Officer Mayo Hospital Lahore**ABSTRACT**

**Back ground & objectives :** The association of raised serum uric acid levels with various cardiovascular risk factors has often led to the debate of whether raised serum uric acid levels could be an independent risk factor in essential hypertension. Hence we carried out a study to examine the possibility of hyperuricemia causing hypertension, to see if there is a relationship between the serum uric acid levels and severity & duration of hypertension

**Methodology :** The study was carried out in THQ Hospital Shakargarh from March 2017 to September 2017. A total of 400 patients were studied of which 200 were cases and 200 controls. The patients were included if they satisfied the JNC VII criteria for hypertension. They were excluded if they were having any other condition known to cause raised serum uric acid levels & secondary hypertension.

**Results :** The study showed that serum uric acid levels were raised in patients with hypertension in comparison to normotensives. The Mean SUA levels between cases and controls were  $6.104 \pm 1.576$  and  $5.685 \pm 1.338$  respectively.  $t$ -value = 2.866,  $p$  - value = .004. SUA levels in the stages of hypertension showed a mean serum uric acid level in stage 1 hypertension of  $5.0312 \pm .77$  and stage 2 hypertension  $6.4421 \pm 1.615$  the  $t$ - value of 8.213 and  $p$ - value = .000 which was significant .SUA level in patients with hypertension < 5 years was  $5.163 \pm 1.255$  those with  $\geq 5$  years was  $6.972 \pm 1.326$ .  $t$ -value of 9.891,  $p$ -value = .000 which was also significant.

**Interpretation & Conclusion:** Based on the study carried out we concluded that SUA can be used as an early biochemical marker to determine the severity and duration of hypertension.

**Keywords:** Serum Uric Acid; Hypertension; JNC VII; Hyperuricemia.

**INTRODUCTION**

Uric acid, which serves no biochemical function other than being an end product of purine metabolism, was first discovered in 1776. A Swedish chemist Scheele isolated it from a urinary tract stone. In 1797, a British chemist Wallaston detected uric acid in a tophus which was removed from his own ear. About 50 years later Alfred Baring Garrod, a British physician showed by chemical isolation that uric acid was abnormally high in gouty patients. In subsequent studies Garrod formulated a rational relationship

between hyperuricemia and symptomatology of gouty patients.<sup>1-2</sup>

Association between hypertension and hyperuricemia was recognized when a family with a unique and unfortunate pedigree attended Hammer Smith hospital in 1957.<sup>3</sup> The father and six of the seven siblings had hyperuricemia, while the mother and all the siblings had hypertension.<sup>4</sup> This raised the question whether a raised serum uric acid was common in patients with hypertension.<sup>5</sup>

Raised serum uric acid has been reported to be associated with an increased risk of coronary heart disease and is commonly encountered with essential hypertension, even untreated hypertension, and type 2 diabetes, which are in turn associated with coronary heart disease. It is not known whether raised serum uric acid increases the risk of hypertension and type 2 diabetes independently of known risk factors such as age, obesity, alcohol consumption, and physical activity.<sup>6-7</sup> This study was done to determine whether raised serum uric acid levels were an independent risk factor for developing hypertension.

### MATERIAL AND METHODS

This case/control study was conducted at THQ Hospital Shakargarh from March 2017 to September 2017.

Total 400 adult male and female patients > 18 years of age diagnosed as hypertensive according to JNC VII classification for hypertension were included as cases; patients were excluded if they had diabetes mellitus, ischemic heart disease and secondary hypertension. Controls were patients without hypertension or any other condition known to cause hyperuricemia and were matched for age and sex with that of the cases. Clinical examination of all the patients was done and history was taken along with demographic profile of all the patients. Hypertension was defined according to the JNC VII classification of hypertension as those with SBP of < 120 mm hg and DBP of < 80 mm hg as normal, those with SBP of 120- 139 mm hg or DBP of 80 - 89 mm hg were labeled pre-hypertensive were not taken up for the study, those with SBP 140 -159 mm hg or DBP of 90 - 99 mm hg were labeled as having Stage 1 hypertension, and those with SBP  $\geq$  160 or DBP  $\geq$  100 mm hg were labeled as Stage 2 hypertension. Blood sample of all the patients was taken and sent to laboratory for analysis of serum uric acid. Laboratory findings were noted on pre-designed proforma. Collected data was entered in SPSS version 20 and analyzed. Mean and SD was calculated for numerical data and percentages were calculated for categorical data.

### RESULTS

Minimum age of the patients was 20 years and maximum age was 89 years. Age group 40-49 years and age group 60-69 years found with higher number of patients. (Table 1)

Total number of male patients was 145 and the total no female patients were 55 both in cases and controls. The Serum Uric Acid levels in male cases ranged from 3.8 mg/dl to 9.8 mg/dl and female cases ranged from 3.2 mg/dl to 9.5mg/dl. The Serum Uric Acid levels in male controls ranged from 2.8 - 9 mg/dl and female controls ranged from 3 - 8.4mg/dl. (Table 2)

The total number of cases were 200 (both male and female), the data analysis of the cases showed the mean SUA level to be 6.104 with a standard deviation of 1.576 ( $6.104 \pm 1.576$ ).

The total number of controls of controls were 200 (both male and female), the data analyzed showed a mean SUA level of 5.685 with a standard deviation of 1.338 ( $5.685 \pm 1.338$ ).

P value = .004 which was significant. This showed that there was a significant rise in serum uric acid levels in patients with hypertension when compared to normotensive. (Table 3)

The severity of hypertension was divided into stage 1 and stage 2 based on the JNC VII classification of hypertension. In the study done at our hospital the total number of patients assessed to have stage 1 hypertension was 48 patients (both male and female patients), the total number of patients having stage 2 hypertension was 152(both male and female patients). The data analysis for SUA levels in the stages of hypertension showed a mean serum uric acid level in stage 1 hypertension of 5.0312 with a standard deviation of  $\pm .77$ . The mean serum uric acid levels in stage 2 hypertensive patient were 6.4421 with a standard deviation of 1.615. P-value of 0.000 which was significant. The data analyzed showed that there was a significant rise in hypertension in patients who were having stage 2 hypertension i.e. those with a SBP  $\geq$  160 and a DBP  $\geq$  100 than those with stage 1 hypertension (SBP 140- 159 and DBP 90 - 99) (Table 4)

The duration of hypertension was divided into 2 categories - those with hypertension for duration of hypertension < 5 years and those with a duration of hypertension ≥ 5 years. The total number of patients with hypertension for duration of < 5 years was 96, and the total number of patients with duration of hypertension ≥ 5 years was 104. The mean SUA level in patients with

hypertension < 5 years was 5.163 with a standard deviation of 1.255. The mean SUA level in patients with hypertension ≥ 5 years was 6.972 with a standard deviation of 1.326. The analyzed data showed a p-value = .000 which showed that there is significant increase in SUA levels in patients with hypertension ≥ 5 years than those with a duration of < 5 years. (Table 5)

**Table – 1**Age distribution for cases and controls

Age group	CASES	CONTROLS
20 - 29	13	13
30 - 39	14	14
40 - 49	55	55
50 - 59	37	37
60 - 69	55	55
70 - 79	21	21
80 - 89	5	5

**Table- 2**Sex Distribution of cases and Controls

Gender	Cases	Controls
Male	145	55
Female	145	55

**Table 3:**SUA Levels between Cases and Controls

Group	Number	Mean ± SD
Cases	200	6.104 ± 1.576
Controls	200	5.685 ± 1.338

**Table 4:**SUA based on stage of Hypertension (JNC VII)

Stage of hypertension	Number	Mean ± SD
Stage 1	48	5.0312 ± .77
Stage 2	152	6.4421 ± 1.615

**Table 5:**SUA Levels Based on duration of Hypertension

Duration of hypertension	Number of patients	Mean ± SD
< 5 years	96	5.163 ± 1.255
≥ 5 years	104	6.972 ± 1.326

## DISCUSSION

Elevated SUA levels have been associated with an increased risk for cardiovascular disease. The potential mechanisms by which SUA may directly affect cardiovascular risk include enhanced platelet aggregation and inflammatory activation of the endothelium.<sup>8</sup>In the present study the incidence of hyperuricemia in controls was 17% and the incidence of hyperuricemia in cases was 37 %. Various other studies have also shown that increased SUA levels were seen in hypertensive

patients. Kinsey (1961) in his study with 400 hypertensive patients reported a 46 % incidence of hyperuricemia in hypertensives.<sup>9</sup> Kolbe (1965) in his study of 46 hypertensive patients found 26 to be having increased SUA levels (56 %).<sup>10</sup> A. Breckenridge (1966) showed 274 of 470 patients on antihypertensive treatment (58%) had raised SUA levels and 90 of the 333 patients (27%) attending the clinic for the time had hyperuricemia<sup>1</sup>. In a study by C. J. Bulpitt (1975), 48 % malehypertensives and 40 % female

hypertensives had their SUA level in the hyperuricemic range.<sup>11</sup>

Ramsay (1979) in his study of 73 men with untreated hypertension had 18 with raised serum uric acid levels (25%).<sup>12</sup> Messerli et al (1980) had an incidence of 72 % raised SUA in their study population of 39 established hypertensives. Messerli and Frohlich et al hypothesized that the frequent presence of hyperuricemia in hypertensive patients reflects underlying renal dysfunction or reduced renal perfusion.<sup>13</sup> In our study the incidence of Hyperuricemia in cases with stage 1 hypertension was 4.2 % and those with stage 2 hypertension was 42.11 % As to the possibility as to whether SUA levels was related to the severity and duration of hypertension, Breckenridge in his study showed an increasing incidence of hyperuricemia as the diastolic BP increased in his study, but there was no tendency for hyperuricemia to occur, only with patients with more severe hypertension.

The PIUMA study demonstrates a strong independent association between SUA and CV risk in initially untreated and asymptomatic adult subjects with essential hypertension, but it is unable to answer the question of whether SUA exerts direct toxic effects. As extensively reviewed by Puig and Ruilope,<sup>14</sup> both uric acid and superoxide radicals are produced for the effect of xanthine oxidase in the late phase of purine metabolism. Superoxide radicals, which may cause tissue and vascular damage,<sup>15</sup> are increased in subjects with essential hypertension.<sup>16</sup> It would be important to clarify whether such increase is due, at least in part, to enhanced xanthine oxidase activity and whether inhibition of this enzyme by allopurinol may reduce CV risk.<sup>17</sup> In our study we found that there is definite relation in SUA levels between hypertensive patients and normotensive patients and there is a directly proportional relation in the levels of SUA in relation 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.

## CONCLUSION

With the results based on the study carried out we concluded that there can be a direct relation between hyperuricemia and hypertension. Also the study showed that the SUA levels were significantly increased in patients with Stage 2 hypertension in comparison with those with stage 1 hypertension, showing that the severity of hypertension also related to the SUA levels. The study also showed that the duration of hypertension had a significant impact on the SUA levels, those with a longer duration of hypertension had significantly raised SUA levels when compared with those of a lesser duration.

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