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Association of serum uric acid with blood pressure in essential hypertension

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ABSTRACT:

INTRODUCTION: Hypertension (HTN) is defined as the systolic blood pressure (SBP) values of 130 mm Hg or more and/or diastolic blood pressure (DBP) of more than 80 mm Hg. Various research studies have shown the conflicting result about association of serum uric acid with blood pressure in essential hypertensive subjects. Hence, this study was conducted to find the association of serum uric acid with blood pressure in essential hypertension. **MATERIAL AND METHODS:** 50 hypertensive subjects were included in study. Blood pressure was measure by an automatic blood pressure measuring device OMRON after the subjects had rested for at least 10 minutes in a sitting position. Serum uric acid was estimated by Uricase-Peroxidase via ERBA CHEM – 5 PLUS SEMIAUTO ANALYZER. **RESULTS:** The Serum Uric acid, systolic BP and diastolic BP were increased in hypertensive subjects as compared to normal values. Blood pressure and serum uric acid in male hypertensive subjects were significantly as compared to female hypertensive subjects but diastolic BP was non-significantly increased in male hypertensive subjects as compared to female hypertensive subjects. There was significant positively correlation between serum Uric acid with systolic BP and diastolic BP in hypertensive subjects, male hypertensive subjects and female subjective respectively. **CONCLUSION:** The serum uric acid was positively correlated with BP in hypertensive patients. So it can be concluded that in clinical practices, measurement of serum uric acid level may help to identify the risk of hypertension. Moreover, further studies can be carried out to lower the serum uric acid level to maintain a low risk of hypertension or to translate high risk of hypertension into a lower risk of hypertension.

KEYWORDS: Hypertension, Systolic Blood Pressure, Diastolic Blood Pressure, Uric Acid

INTRODUCTION: Hypertension (HTN) is defined as the systolic blood pressure (SBP) values of 130 mm Hg or more and/or diastolic blood pressure (DBP) of more than 80 mm Hg [1]. Hypertension has shown an increasing prevalence in Indian adults and the numbers are estimated to be 213 million by 2025[2]. Hypertension can be classified as primary/essential hypertension or secondary hypertension. There is no any underlying cause of essential hypertension [3]. Essential hypertension is prevailing cause of hypertension impacting 90-95% of total hypertensive patients [4].

Uric acid is an end product of purine metabolism produced in blood from endogenous purine substances and from diet [5]. Alcoholic and high-purine foods consumption, low water consumption and/or poor physical activities are contributing factors responsible for hyperuricemia [6,7]. Hyperuricemia may be defined as a plasma (or serum) urate concentration >420 $\mu\text{mol/L}$ (7.0mg/dL). This definition is based on physicochemical, epidemiologic, and disease-related criteria [8]. There have been many studies which have described the association between obesity, dyslipidemia, and hypertension with elevated levels of uric acid in adults [9-13] all of which are also associated with increased risk for cardiovascular disease. Serum uric acid levels also have shown to play a very important role in the development of cardiovascular morbidity and renal disease progression in the patients with hypertension [14-16]. Nevertheless, it remains unknown whether uric acid is an independent risk factor, a mediator or merely a marker for the development of HTN [17-18].

The association of hyperuricemia with hypertension has long been recognized with early researchers and hypothesizing that uric acid might be a cause of hypertension or renal disease[19-20]. The other contributory factors that may show association between uric acid and hypertension includes alcohol abuse, lead intoxication, obesity and insulin resistance, and diuretic use [21]. However given that the results linking uric acid and hypertension are not entirely consistent [22-23]. Hence this study was carried out to investigate the relationship between uric acid and blood pressure in essential hypertension.

MATERIAL AND METHODS: The study was conducted in biochemistry department among the hypertensive patients attending the General Medicine OPD of Rama Medical College, Mandhana, Kanpur (U.P). 50 hypertensive subjects were included in study. The medical records of these patients were revived and details such as medical history, age, sex, B.P was measured at time of assessment through a standard questionnaire Blood pressure will be recorded as average of 2 readings after initial screening from the right arm placed at the heart level using an automatic blood pressure measuring device OMRON after the subjects had rested for at least 10 minutes in a sitting position. The measurements were taken 60 seconds apart and the average systolic and diastolic blood pressures were recorded and used for analyses. Hypertension was defined as a systolic blood pressure ≥ 140 mmHg and or diastolic pressure ≥ 90 mmHg, Pre-hypertension as systolic pressure 120-139 mmHg and or diastolic pressure 80-89mmHg and Normotension as systolic pressure <120 mmHg and Diastolic blood pressure as <80 mmHg according to the seventh report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-7). Serum uric acid was estimated by Uricase-Peroxidase via ERBA CHEM – 5 PLUS SEMIAUTO ANALYZER.

STATISTICAL ANALYSIS: The serum uric acid levels of both the group were analyzed for mean, and standard deviation. The results were expressed in Mean ± standard deviation (S.D.). Data was analyzed by statistical software SPSS VERSION 25.0.

P-values considered significant were as follows: P <0.05– As significant, P <0.001 – As highly significant

OBSERVATION AND RESULTS: Mean and standard deviations (SD) of blood pressure and serum uric acid in hypertensive subjects were shown in table 1. The Serum Uric acid, systolic BP and diastolic BP were increased in hypertensive subjects as compared to normal values. Table 2 showing the blood pressure and serum uric acid in male and female hypertensive subjects in whom the systolic BP and serum uric acid were significantly increased in male hypertensive subjects as compared to female hypertensive subjects but diastolic BP was non-significantly increased in male hypertensive subjects as compared to female hypertensive subjects. Table 3 showing the correlation of Serum Uric acid with systolic BP and diastolic BP in hypertensive subjects in whom there was significant positive correlation was found. Similarly table 4 and 5 showing the correlation of Serum Uric acid with systolic BP and diastolic BP in male hypertensive subjects and female subjective respectively in whom there was significant positive correlation was found.

Table1: Showing the of blood pressure and serum uric acid in hypertensive subjects

| Parameters | Mean ±S.D. | Normal Values |
|-------------------------|------------|---------------|
| Systolic BP (mm Hg) | 150 ± 11 | 110–120 mmHg |
| Diastolic BP (mm Hg) | 93 ± 7 | 75–80 mmHg |
| Serum Uric acid (mg/dl) | 7.48 ±0.84 | 3-7 mg/dl |

Table 2: Showing the of blood pressure and serum uric acid in male and female hypertensive subjects

| Parameters | Male hypertensive subjects (n=27) Mean ±S.D. | Female hypertensive subjects (n=23) (Mean ±S.D.) | P-value |
|----------------------|---|---|---------|
| Systolic BP (mm Hg) | 153 ±11 | 147 ± 9 | 0.04* |
| Diastolic BP (mm Hg) | 94 ±7 | 92 ±6 | 0.2 |

| | | | |
|-------------------------|-----------|-------------|-------|
| Serum Uric acid (mg/dl) | 7.73±0.90 | 7.19 ± 0.67 | 0.02* |
|-------------------------|-----------|-------------|-------|

Table 3: Showing the correlation of Serum Uric acid with systolic BP and diastolic BP in hypertensive subjects

| Parameters | Serum Uric acid | P-value |
|----------------------|-----------------|---------|
| Systolic BP (mm Hg) | r = 0.77 | <0.01** |
| Diastolic BP (mm Hg) | r = 0.89 | <0.01** |

Table 4: Showing the correlation of Serum Uric acid with systolic BP and diastolic BP in male hypertensive subjects

| Parameters | Serum Uric acid | P-value |
|----------------------|-----------------|---------|
| Systolic BP (mm Hg) | r = 0.66 | <0.01** |
| Diastolic BP (mm Hg) | r = 0.89 | <0.01** |

Table 5: Showing the correlation of Serum Uric acid with systolic BP and diastolic BP in female hypertensive subjects

| Parameters | Serum Uric acid | P-value |
|----------------------|-----------------|---------|
| Systolic BP (mm Hg) | r = 0.94 | <0.01** |
| Diastolic BP (mm Hg) | r = 0.90 | <0.01** |

DISCUSSION AND CONCLUSION: The Serum Uric acid, systolic BP and diastolic BP were increased in hypertensive subjects as compared to normal values. There was significant positive correlation between serum uric acid with systolic BP and diastolic BP in hypertensive subjects. The systolic BP and Serum uric acid was significantly increased in male hypertensive subjects as compared to female hypertensive subjects. Similar finding was obtained by Ali N et al., in which Males had a higher mean level of serum uric acid than in the females. They also found that the serum uric acid levels were significantly associated with hypertension ($p < 0.01$) [24].

In this study there was significant positive correlation between serum uric acid with systolic BP and diastolic BP in male and female hypertensive subjects. This present study had shown that serum uric acid was significantly associated with blood pressure levels in men. Kansui Y et al., had studied the association of serum uric acid with Blood Pressure in Japanese men- a cross-sectional study in work-site group and found that both Systolic blood pressure and diastolic blood pressure were significantly correlated with serum uric acid levels [25].

In this study the association of serum uric acid with BP is more strongly associated in female hypertensive subjects as compared to male hypertensive subjects. Similar finding had been found by Lee J J et al., which studied the relationship between uric acid and blood pressure in different age groups and found that the association between serum uric acid and BP was stronger in women <40 ($\beta = 0.54, p < 0.001$ for systolic BP; $\beta = 0.65, p < 0.001$ for diastolic BP) and in between 40 and 59 ($\beta = 0.51, p < 0.001$ for diastolic BP) [26]. In certain studies it has been found that the uric acid lowering therapy can reduce BP in hypertension associated with

hyperuricemia [26-30].

In the present study, although it is showed that serum uric acid levels are correlated with the severity of both SBP and DBP, the correlation coefficients (r) were 0.77 and 0.89, respectively, a significant correlation. Increased serum uric acid levels are thought to be only one of many pathogenesis factors that lead to high blood pressure. Experimental studies have reported that hyperuricemia induces systemic hypertension and renal injury via activation of the rennin angiotensin system, and direct entry of uric acid into both endothelial and vascular smooth muscle cells, resulting in local inhibition of endothelial nitric oxide levels, stimulation of vascular smooth muscle cell proliferation, and stimulation of vasoactive and inflammatory mediators [31, 32].

In conclusion, the serum uric acid was positively correlated with BP in hypertensive patients. So it can be concluded that in clinical practices, measurement of serum uric acid level may help to identify the risk of hypertension. Moreover, further studies can be carried out to lower the serum uric acid level to maintain a low risk of hypertension or to translate high risk of hypertension into a lower risk of hypertension.

CONFLICT OF INTEREST: There was no any conflict of interest in this research work.

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