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"Study of association of serum uric acid levels with severity of essential hypertension: a cross sectional study".

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Abstract:

It has been found in many studies that elevated UA is a risk factor for the development of cardiovascular disease. It is unknown whether UA independently predicts target organ damage in patients with hypertension. In view of this, we undertook the present study to evaluate the association of serum uric acid level with target organ damage in essential hypertension. Present study was cross sectional in nature conducted on 66 essential hypertensive patients. All patients fulfilling inclusion criteria and exclusion criteria were taken up for the study. Majority of the patients was in the age group of 40-60 years and most of them were male. Out of total 66 hypertensive patients, majority, 28 (42.42%) did not have any target organ damage followed by 22 (33.33%) cases had one organ damage and 16 (24.24%) had two organ damage. Of the 38 cases having damaged organ; 12 (31.57%) was having left ventricular hypertrophy, 10 (26.32%) was having micro albuminuria and 16 (42.11%) was having both, LVH as well as micro albuminuria. Mean SUA was 7.98 + 3.9 mg/L, 6.79 +2.77 mg/L and 5.67 + 1.88 mg/L among cases with two, one and no organ damage respectively, which differed significantly between these three groups (p=0.002). Increased serum uric acid level (SUA) was significantly associated with number of organ damaged and severity of hypertension.

Key words: serum uric acid level (SUA), micro albuminuria, target organ damage, LVH, essential hypertension.

Study of Association of serum uric acid levels with severity of essential hypertension: A Cross sectional Study

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Introduction:

Hypertension is an important cardiovascular problem worldwide.[1] Its magnitude is increasing in developing countries including India.[2] Hypertension has adverse effects on various target organs, increasing the risk of stroke, coronary heart disease, and heart failure.[3] It is also associated with decline in cognitive and renal function.[3] Serum uric acid, one of the biochemical markers elevated in cases of hypertension and further associated with complications. [4,5]

It has been found in many studies that elevated UA is a risk factor for the development of cardiovascular disease, and the European Society of Hypertension–Cardiology guidelines recommend performing routine laboratory testing for serum UA (SUA) in patients with hypertension.[6,7] However, it is unknown whether UA independently predicts target organ damage in patients with hypertension. In light of this, we undertook the present study at tertiary care hospital in Amravati, Maharashtra, with the aim of studying the association of serum uric acid level with target organ damage in essential hypertension.

Objectives

To study the association of serum uric acid level with target organ damage in essential hypertension.

Materials and Methods

The protocol of this cross-sectional study was approved by the Institutional Ethical committee of the medical college. Written informed consent was taken from all study subjects.

All patients fulfilling inclusion criteria and exclusion criteria admitted in general medicine ward of Dr. PDMMC and tertiary care hospital were taken up for the study until fulfilling the required sample size. Study was carried out over a period of three months from August to October 2021.

Inclusion criteria include male and female patients >18 year of age, newly diagnosed with essential hypertension admitted in Tertiary Care Hospital. The diagnosis of essential hypertension was established and the patients were categorized into various stages of hypertension according to JNC-VII report. Those patients having history of secondary hypertension, diabetes, hypothyroidism, hyperparathyroidism, pregnancy induced hypertension,

ischemic heart disease, congestive cardiac failure, obesity (body weight exceeding 25% of ideal weight), alcohol abuse, renal insufficiency, glomerulonephritis, pyelonephritis, hereditary nephropathy, gout, lymphoproliferative or myeloproliferative disorders etc. were excluded from the study. Patients on management with drugs altering uric acid levels such as thiazides, loop diuretics, pyrazinamide, allopurinol, levodopa, ethambutol, cytotoxic drugs etc. were also excluded from this study. All patients were evaluated by history, clinical examination and appropriate laboratory investigations. All demographic data, detailed history, past treatment history/any comorbid illnesses were recorded in a pre-structured proforma. A complete physical examination, vital signs and relevant investigations were noted from records. These included an Hb, CBC, urine albumin, serum uric acid, serum creatinine etc. Outcome of essential hypertension i.e. severity was assessed by the degree of organ damage which was determined by the number of target organs involved (ie, 0= no TOD; 1 TOD = presence of either LVH or microalbuminuria; 2 TOD = presence of both LVH and microalbuminuria).

Uric acid- UA was analyzed with the enzymatic colorimetric method using an autoanalyzer. Hyperuricemia was defined as the serum uric acid >7.0 mg/dl in adult males, >6.0 mg/dl in adult females.

Sample Size: Erika S. W. Jones et al[8] (2018) in their study on Hypertension in adolescents and young adults referred to a tertiary hypertension clinic, found that prevalence of essential hypertension was 78.2%, considering this proportion & 10% absolute error, at 95% confidence interval, sample size came out to be 66 but we have rounded this figure to 100 for convenience of calculations. Sample size was calculated with n = [DEFF*Np(1-p)]/ [$(d^2/Z^2_{1-\alpha/2}$*(N-1)+p*(1-p)] using OPENEPI software version 3.

Sample size $n = \frac{4 \times P \times Q}{L^2}$

P= Proportion = 78.2%

Q= 100-P = 21.8%

L= Absolute error = 10%

$n = \frac{3.84 \times 78.2 \times 21.8}{10 \times 10}$

= 66

So, the sample size was 66 and sampling method was consecutive method of convenient sampling. Pre-validated, pretested, semi structured questionnaire was used as data collection tool. Data was entered in Microsoft Excel and analyzed using SPSS Software.

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Results:

In the present cross-sectional study, there was no denial to participate in the study, so the response rate was 100%. Maximum, 38 (57.57%) cases were from the age group of 40-60 years followed by 17 (25.76%) from the age group of >60 years and least 11 (16.67%) from the age group <40 years. Most, 42 (63.64%) of the patients were male and 24 (36.36%) was females. According to JNC VII criteria majority, 36 (54.55%) were having stage II hypertension followed by 30 (45.45%) having stage I hypertension. (Table 1)

Table 1. Distribution of patients according to baseline characteristics.

Baseline characteristic		**Frequency (no.)**	**Percentage (%)**
Age	<40	11	16.67
	40-60	38	57.57
	>60	17	25.76
Gender	Male	42	63.64
	Female	24	36.36
JNC VII stage	Stage I	30	45.45
	Stage II	36	54.55

Mean systolic blood pressure in stage II patients was (174.44 $\pm$ 16.32 mmHg) significantly more than the stage I patients (149.44 $\pm$ 6.20 mmHg). Also, mean diastolic blood pressure in stage II patients was (96.66 $\pm$ 1.88 mmHg) significantly more than the stage I patients (116.22 $\pm$ 4.78 mmHg) ($p<0.0001$). (Table 2)

Table 2. Comparison of mean blood pressure according to stage of hypertension as per JNC VII criteria.

Stage of hypertension	**Mean blood pressure**	
	Systolic	**Diastolic**
Stage I	149.44±6.20	96.66±1.88
Stage II	174.44±16.32	116.22±4.78
p	<0.0001	<0.0001

In our study, when we assessed the serum uric acid concentrations among these hypertensive cases, we have noticed that mean serum uric acid (SUA) level did not differ according to various age groups and gender

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(p>0.05). But mean serum uric acid (SUA) level differed significantly according to JNC VII stages, and it was more among stage II (7.98 ± 1.85 mg/L) hypertensives than the stage I hypertensive patients (6.09 ± 2.97 mg/L) (p=0.002) (Table 3)

Table 3. Serum uric acid level as per baseline characteristics.

Sr. No.	Baseline characteristic		Mean SUA (mg/L)	p
1	Age groups	<40 (n=11)	6.53±2.88	0.8
		40-60 (n=38)	7.11±3.22	
		>60 (n=17)	6.99±2.88	
2	Gender	Male (n=42)	7.08±3.22	0.8
		Female (n=24)	6.92±2.76	
3	JNC VII stage	Stage I (n=30)	6.09±2.97	**0.002**
		Stage II (n=36)	7.98±1.85	

Fortunately, out of total 66 hypertensive patients, majority, 28 (42.42%) did not have any target organ damage followed by 22 (33.33%) cases had one organ damage and 16 (24.24%) had two organ damage. Of the 38 cases having damaged organ; 12 (31.57%) was having left ventricular hypertrophy, 10 (26.32%) was having microalbuminuria and 16 (42.11%) was having both, LVH as well as microalbuminuria. Mean SUA was 7.98 + 3.9 mg/L, 6.79 +2.77 mg/L and 5.67 + 1.88 mg/L among cases with two, one and no organ damage respectively, which differed significantly between these three groups (p=0.002). (Table 4 & Table 5)

Table 4. Distribution of patients according to number of target organ damaged and mean SUA.

No. of target organ damaged	No. (%)	Mean SUA (mg/L)	P
0	28 (42.42)	5.67±1.98	
1	22 (33.33)	6.79±2.77	**0.03**
2	16 (24.24)	7.98±3.90	

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Table 5. Distribution of patients according to type of target organ damage. (n=38)

Type of target organ damage	No.	(%)
LVH	12	31.57
Microalbuminuria	10	26.32
Both	16	42.11
Total	38	100

Discussion:

This present study was cross-sectional to analyze serum uric acid levels in essential hypertensive patients to assess its relation with target organ damage. Mean age of the patients was 54.8 years with majority of them were males. Maximum (57.57%) cases were from the age group of 40-60 years. According to JNC VII criteria, majority (54.55%) were having stage II hypertension followed by 45.45% having stage I hypertension. Mean systolic blood pressure in stage II patients was significantly more than the stage I patients. Also, mean diastolic blood pressure in stage II patients was significantly more than the stage I patients ($p<0.0001$). These findings are consistent with Kothia Divyen et al.[9] who reported majority patients were from 40-60 years with most of them males & Waseem Ramzan Dar et al[5] who found most of the cases had stage II hypertension with significantly higher mean systolic and diastolic blood pressure.

In our study, when we assessed the serum uric acid concentrations among these hypertensive cases, we have noticed that mean serum uric acid (SUA) level did not differ according to various age groups and gender ($p>0.05$). But mean serum uric acid (SUA) level differed significantly according to JNC VII stages, and it was more among stage II (7.98 $\pm$ 1.85 mg/L) hypertensives than the stage I hypertensive patients (6.09 $\pm$ 2.97 mg/L) ($p=0.002$). Similar to our study, Kothia Divyen et al[9] also observed significant hyperuricemia in stage II cases than the stage I and Waseem Ramzan Dar et al[5] reported significantly higher serum uric acid levels in stage 2.

Fortunately, out of total 66 hypertensive patients, majority, 28 (42.42%) did not have any target organ damage followed by 22 (33.33%) cases had one organ damage and 16 (24.24%) had two organ damage. Of the 38 cases having damaged organ; 12 (31.57%) was having left ventricular hypertrophy, 10 (26.32%) was having microalbuminuria and 16 (42.11%) was having both, LVH as well as microalbuminuria. Mean SUA was 7.98 + 3.9

mg/L, 6.79 +2.77 mg/L and 5.67 + 1.88 mg/L among cases with two, one and no organ damage respectively, which differed significantly between these three groups (p=0.002). This is in agreement with Sandra N Ofori et al[4] who also found hyperuricemia was significantly associated with organ damage, most common of which was LVH which is in contrast to our study.

Conclusion:

Increased serum uric acid level (SUA) was significantly associated with number of organ damaged and severity of hypertension.

Declaration:

There was no source of funding in our study and there was no any conflict of interest.

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