

Study of Serum Uric Acid Levels in Essential Hypertension and its correlation with the severity of Hypertension

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Abstract

Background: Uric acid is thought to play a pathogenic role in hypertension mediated by several mechanisms such as inflammation, vascular smooth muscle cell proliferation in renal microcirculation, endothelial cell dysfunction etc. The study was carried to see the relationship between serum uric acid and hypertension and its correlation with components of metabolic syndrome as it is thought that hyperuricemia is more common in hypertensive patients probably because hyperuricemia may be also a component of metabolic syndrome.

Methods: The present observational cross sectional study was conducted in the department of Medicine in a tertiary care hospital in Assam from June 2021 to May 2022. A total of 150 patients who were diagnosed as hypertensives following ACC/AHA guidelines, 2017. Newly detected hypertensives were enrolled for the study. Relevant clinical and laboratory data were recorded using proforma and statistical analysis were done accordingly.

Results: 20% cases were found to be hyperuricemic in the study population out of which 67% of the cases who had metabolic syndrome had hyperuricaemia.

Conclusion: There can be a direct relation between hypertension and hyperuricemia, hyperuricemia was found in 20% of hypertensive cases. Serum uric acid level correlates significantly with variables like BMI, Dyslipidemia, stage 2 hypertension, which are components of metabolic syndrome. Thus, hyperuricaemia can be an index of suspicion for the concomitant presence of metabolic syndrome.

Key words: Hypertension, Hyperuricemia, Uric acid, AHA- American Heart Association

Introduction

Hypertension is one of the most common causes of mortality and morbidity amongst adults from all over the world whose prevalence is more than 1.13 billion worldwide¹. Hypertension is a major contributing risk factor for neurological, cardiac, renal and peripheral vascular diseases.

Hypertension is an emerging health problem in India. When majority of people come to know that they have hypertension they have already advanced into a stage with target organ damage – a fatal stroke or myocardial infarction or irreversible renal failure. Unfortunately even in developed countries like United States, 78 million people are found to have hypertension²

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The association between Hypertension and hyperuricemia were found when a family with an unfortunate pedigree attended Hammer Smith hospital in the United States in 1957. The father and six of the seven progeny had hyperuricemia, while the mother and all of the progeny had hypertension³

This incident incited interest in finding the correlation between serum uric acid levels and hypertension

The relationship between hyperuricemia and hypertension has been recognised for a long period of time. However it is an unsolved doubt if the relationship of hyperuricemia and hypertension is purely because of underlying renal and metabolic defects. Uric acid is thought to play a pathogenic role in hypertension mediated by several mechanisms such as inflammation,vascular smooth muscle cell proliferation in renal microcirculation, endothelial cell dysfunction etc.⁴⁻¹⁶

Decreased blood flow to the kidneys and reduced tubular secretion of uric acid are found to be the predominant mechanism as the cause of hyperuricemia in hypertension¹⁷. Moreover it is thought that hyperuricemia is more common in hypertensive patients probably because hyperuricemia may be also a component of metabolic syndrome¹⁸.

Different studies done till date has shown that hyperuricemia is common in hypertensive patients.

According to a study done in Bangladesh, the observed prevalence of hyperuricemia in hypertensive was 9.7%¹⁹.

According to another study done in Medicine department of Agartola government medical college, Agartola in 2020, the prevalence of hyperuricemia was 47.5%²⁰

According to a study done in Uttar Pradesh in the Department of Medicine, GS Medical College and Hospital, Pilkhuwa, Hapur showed that mean serum uric acid levels in cases was 7.14 mg/Dl²¹

Here an attempt will be made to study the prevalence of elevated uric acid levels in hypertensives.

Methods

The present study was an observational cross sectional study which was conducted in the Department of Medicine, Tezpur Medical College and Hospital, Assam from June 2021 to May 2022. A total of 150 patients of 26-65 years of age who were diagnosed as hypertensives following recent ACC/AHA guidelines were taken only after giving written informed consent after full explanation of nature and purpose of the study.

Aims and objectives:

1. To study the clinical profile of hypertensives.
2. To study the relationship between hypertension and serum uric acid level

Excluded those patients who were known case of gout, patients with malignant diseases and patients on chemotherapy and antimetabolite, Pregnant patients, patients of end-stage renal diseases, Patients on uricosuric drugs, patients of secondary hypertension, Patients on drugs known to cause hyperuricaemia and Patients who did not give consent.

A prior written and informed consent (annexure) was obtained before evaluating the cases. Demographic data, history and physical examination were obtained and documented using the designated protocols.

Data was recorded in preformed and pretested proforma. Statistical analysis was done using Microsoft Excel, 2017. P value <0.05 was considered to be statistically significant.

Anthropometric measurements included height and body weight, waist circumference, waist hip ratio which were measured while the subject was wearing light clothing without shoes. The body mass index was calculated as the weight in kilograms divided by the height in m².

Essential hypertension was diagnosed in the absence of an identifiable cause. The patients were classified into various stages of hypertension according to recent ACC/AHA guidelines, 2017. Hyperuricemia was defined as serum uric acid levels >7mgs/dl in males and >6mgs /dl in females. Serum uric acid was measured by photometric method after taking early morning venous sample.

Declaration of Ethical clearance: Taken from ethical committee of Institute

Results

In this cross sectional study, serum uric acid was studied to correlate with the risk factors of hypertension and with other variables. The patients were divided broadly based on their blood pressure levels into two stages-stage 1 hypertensives and stage 2 hypertensives. Mean systolic blood pressure and mean diastolic blood pressure in this study was found to be 150.84 and 91.4 respectively.

Among the 150 patients who were studied,101(67.33%) were males and 49(32.66%) were females.Male to female ratio was 2.06:1

Out of 101 male patients,80 had normal serum uric acid level and 21 had high serum uric acid level

Out of 49 female patients, 40 had normal uric acid level and 9 had high uric acid level.

p value is statistically not significant

Out of 101 male patients, 60 were in stage 1 hypertension and 41 were found to be in stage 2 hypertension, Out of 49 female patients, 22 were in stage 1 hypertension and 27 were in stage 2 hypertension

Table 1: Sex distribution and stages of hypertension

	MALE	FEMALE	TOTAL
STAGE 1	60	22	82
STAGE 2	41	27	68

10 out of 82 stage 1 hypertensives were found to have high uric acid level while 20 out of stage2 hypertensives had high uric acid level.

Table 2: stage of hypertension and uric acid

	NORMAL URIC ACID	HIGH URIC ACID	p value
STAGE 1 (82)	72/82(87.80%)	10/82 (12.19%)	0.008684
STAGE 2 (68)	48/68(70.58%)	20/68 (29.41%)	

p value is 0.008684 which is statistically significant

Patients of 46-55,56-65 year age groups have the highest number of hyperuricemic cases.

Percentagewise it is equal in all the age groups except for 26-35 years age group who has the lowest percentage of 13.63%.

Out of 150 cases,73 were smokers of which 18 had high uric acid level and 12 out of 77 had high uric acid who were non smokers,p value of this correlation is 0.1649 which is insignificant for the study

Table 3: serum uric acid and smokers

Smoking Habit	Normal uric acid	High uric acid	P value
Smokers(73)	55/73 (75.34%)	18/73 (24.65%)	0.1649
Non smokers(77)	65/77 (84.41%)	12/77 (15.58%)	

Out of 50 alcoholics,high serum uric acid was found in 22 cases and 8 cases were found to have high uric acid among non-alcoholics.p value of this correlation was calculated to be 0.00001 which is significant in this study.

Table 4: serum uric acid level and alcoholics

	Normal uric acid	High uric acid	P value
Alcoholic(50)	28/50(56%)	22/50 (44%)	0.00001
Non alcoholic(100)	92/100(92%)	8/100 (8%)	

20 out of 56 patients who had dyslipidemia were found to have high uric acid level while 10 out of 94 patients who did not have dyslipidemia had high uric acid level.p value was calculated to be 0.000204 which is statistically significant

7 out of 30 diabetics had high uric acid level while 23 out of 120 non-diabetics had high uric acid level.p value for this correlation was found to be0.2604 which is non-significant for the study.

Table 5: serum uric acid and glycemc status

Glycemc status	NORMAL URIC ACID	HIGH URIC ACID	p value
DIABETICS(30)	23/30 (76.66%)	7/30 (23.33%)	0.2604
NON DIABETICS (120)	97/120 (80.83%)	23/120 (19.16%)	

19 out of 49 cases who had BMI>25 were found to have high uric acid, on the other hand 11 out of 101 cases who had BMI<25 were found to have high uric acid level.

Table 6: serum uric acid and BMI

	NORMAL URIC ACID	HIGH URIC ACID	p value
BMI>25 (49)	30/49 (61.22%)	19/49 (38.77%)	0.000062
BMI<25 (101)	90/101 (89.10%)	11/101 (10.89%)	

20 out of 51 cases who had metabolic syndrome were found to have high uric acid, on the other hand 10 out of 99 cases who did not have metabolic syndrome were found to have high uric acid level. **P value was 0.000024 which is statistically significant**

There was a strong correlation between serum uric acid and BMI, change in BMI correlates with change in serum uric acid level. There is also positive correlation between BMI and serum uric acid, that is any increase in BMI will increase serum uric acid and decrease in BMI will decrease uric acid.

Discussion

Hyperuricemia has been associated with an increased risk for cardiovascular disease; enhanced platelet aggregation and inflammatory activation of the endothelium²² are the mechanisms by which SUA may directly affect the cardiovascular system. Some studies showed, the association of SUA with cardiovascular disease was uncertain after multivariate adjustment as in the Framingham Heart Study (1985) and the ARIC study (1996), but in others the association remained certain and significant. As because hyperuricemia is correlated with several risk factors including hypertension, renal dysfunction, insulin resistance, hyperlipidemia and hyperhomocystenemia, it is a major debate whether SUA independently causes cardiovascular risks. Various other reports have also shown that increased Serum Uric Acid levels were seen in hypertensive patients.

Kinsey et al. (1961) in his study with 400 hypertensive patients reported a 46% incidence of hyperuricemia in hypertensives²³. Kolbe et al. (1965) in his study of 46 hypertensive patients found 26 to be having increased SUA levels (56%)²⁴.

Breckinridge et al. (1966) demonstrated that 273 out of 460 patients on antihypertensives, 57% had elevated hyperuricemia and 92 of the 323 patients 28% attending the hospital for the first time had hyperuricemia. C. J. Bulpitt et al. (1975) showed in his study that 41% female hypertensives and 47% male hypertensives had hyperuricemia²⁵.

A study by Ramsay et al. (1979) showed that 73 men with untreated hypertension had raised serum uric acid levels 25%²⁶. Meserli et al. (1980) proved an incidence of 71% hyperuricemia in their case population of 38 established hypertensives. Meserli and Frolich et al. demonstrated that the significant presence of hyperuricemia in hypertensives construes to underlying renal failure²⁷.

There is enough evidence that uric acid is sensitive and early marker for renal failure than creatinine. Serum UA has a role in the generation of free radicals. Free radicals inhibit vasodilation of endothelium⁴⁻¹⁶.

Therefore, it is unlikely that hypertension arises as a result of raised serum UA levels, but there is a possibility that uric acid which plays a role in the production of oxidative stress and free radicals must correlate with elevated formation of free radicals.

Hence the fact that raised serum UA levels can lead to Hypertension cannot be entirely ruled out.

Among the 150 cases of hypertension, hyperuricemia was seen in 30 cases, which is 20% of the cases. Canon et al (1996) showed a prevalence of hyperuricemia in 25% of untreated hypertensive cases. The Framingham study observed that the correlation of blood pressure with uric acid was reduced in the case population as they increased in age (source: Feig and Johnson 2003)²⁸

The mean serum uric acid level in stage 1 hypertensives is 5.56 while in stage 2 hypertensives it is 6.64. This correlates with the study done by Ghosh Atanu et al. (2020) in which they have shown that the serum UA level was more in stage 2 hypertensives when related to stage 1 hypertensives²⁰. Overall mean and standard deviation of serum uric acid was 6.05 and 1.16 respectively in this study.

Conclusion

Based on the results of our study, we found that there can be a direct relation between hypertension and hyperuricemia. Hyperuricemia is found in 20% of hypertensive cases. Serum uric acid level correlates significantly with variables like BMI, Dyslipidemia, stage 2 hypertension, which are components of metabolic syndrome. Thus, we can conclude that high serum uric acid level can be an index of suspicion for the concomitant presence of metabolic syndrome. Physicians should thus recognize that the metabolic syndrome is a frequent comorbidity of hyperuricemia and one should be aware of its complications.

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