

Study of serum Uric acid levels in Essential hypertension – A case control study

¹PuliSampath Benarjee ². VutukuriSudhaPriyanka ³. Prahallad Chandra Mishra
⁴. Raya Sravani

Key words: Uric Acid, Hypertension, Essential hypertension

Date of Submission: 01-01-2023

Date of Acceptance: 10-01-2023

I. Introduction:

One of the primary causes of death and disability among adults worldwide is hypertension. It continues to be the predominant risk factor for cerebral, peripheral, and coronary vascular disease. Essential hypertension constitutes more than 90% of the hypertensive cases, defined as systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg(1). In 2000, it was estimated that more than seven million fatalities were attributed to high blood pressure. In India, hypertension is a growing health issue. The byproduct of purine metabolism is uric acid, and elevated serum levels of this compound have been linked to the pathophysiology and development of hypertension. Both oxidative stress and intracellular urate activity are implicated in the mechanism causing blood pressure to rise in hyperuricemic patients, with XOR (xanthine-oxidoreductase activity) playing a key role(2). Serum uric acid (UA) >7.0 mg/dl in adult males, >6.0 mg/dl in adult females is considered as Hyperuricemia. Our study aims to investigate the prevalence of high uric acid levels in essential hypertension and to compare it with the controls.

Type of study: Case Control Study

Period of the study: Jan 2021 to Jan 2022

Sample size: 100 cases and 50 controls

Materials & Methods/ Selection of study subjects:

Patients who meet the inclusion and exclusion criteria and have been diagnosed with essential hypertension undergo a thorough medical history, clinical examination, and investigation.

Inclusion criteria:

- Patients who suffer from essential hypertension
- Patients over the age of 25 and patients of both sexes were included.

Exclusion Criteria:

- Patients who suffer from secondary hypertension
- Hyperparathyroidism, hypothyroidism, uncontrolled diabetes.
- Gout.
- Abuse of alcohol.
- Hereditary nephropathy, glomerulonephritis, pyelonephritis, and renal insufficiency.
- Individuals using medication, such as levodopa, ethambutol, pyrazinamide, and nicotinic acid.
- Thiazide diuretics, low dosage aspirin, and cytotoxic medications.

Controls:

Subjects that met the aforementioned exclusion criteria and were over 25 years old with normal blood pressure.

Cases:

A total of 100 cases that met the aforementioned inclusion and exclusion criteria were chosen for further investigation. 50 participants with similar ages and sexes were kept as controls.

Definitions:

1) Primary Hypertension

The JNC- VIII report defines hypertension as having a systolic blood pressure of 140 mm Hg or higher, or a diastolic blood pressure of 90 mm Hg or higher. It was the mean of three seated right arm readings in cases that were just discovered. On the basis of the overall clinical impression alone, the diagnosis was reached that hypertension is primary and not secondary. Each patient did not receive a laboratory analysis to rule out secondary reasons.

Hyperuricemia 2

Serum uric acid values over 7 mg/dl in men and over 6 mg/dl in women are considered to be hyperuricemia.

II. Results:

Mean age of the population was 47.68 ± 1.38 ; Mean age of the controls was 40.16 ± 1.77 ; Mean age of the cases- 51.45 ± 1.38

Among the cases, 60 were males, 40 were females. Among the controls, 31 were males and 19 were females.

Mean Systolic BP among the cases was 159.98 ± 2.25 mm of Hg. Mean Diastolic BP among the cases was 98.96 ± 1.14 mm of Hg.

Mean Systolic BP among the controls was 118.42 ± 3.11 mm of Hg. Mean Diastolic BP among the controls was 76.78 ± 1.89 mm of Hg.

Among the cases, 55 patients also had diabetes and among the controls, 18 had diabetes.

Among the cases, 22 patients had cardiac co-morbidities and among the controls, 8 had cardiac co-morbidities.

The mean serum uric acid levels in the control was 3.94 ± 0.49 mg/dL. The mean serum uric acid levels in the cases was 5.61 ± 0.41 mg/dL.

Elevated serum uric acid levels among the cases was noted in 37 patients, whereas, elevated serum uric acid levels among the controls was noted in 6 patients.

	Cases	Controls
Serum uric acid within normal range	63	44
Serum uric acid elevated	37	6

The data is significant with a p value < 0.05 .

Hence, elevated serum uric acid levels correlate with essential hypertension.

On T-test comparing serum uric acid levels in both the groups, the t -value is 4.81137 and the p value is < 0.05 . So the data is significant.

III. Discussion:

Serum uric acid elevated levels have been considered as separate independent risk factor for development of essential hypertension. The following are some plausible explanations for how hyperuricemia can lead to the development of hypertension: (a) uric acid-induced activation of the renin-angiotensin system (b) increased insulin resistance and hyperinsulinaemia, resulting in decreased excretion of uric acid, sodium, and potassium from renal tubules; and (c) proliferation of vascular smooth muscle and endothelial dysfunction caused by raised uric acid levels(3).

In the present study, mean age of the controls was 40.16 ± 1.77 and the cases was 51.45 ± 1.38 . This correlated well with other studies(4),(5),(6). There was male preponderance in both groups (60 were males among cases and 31 were males among controls).

The cases show high mean systolic/diastolic BP $159.98 \pm 2.25 / 98.96 \pm 1.14$ mm of Hg compared to controls $118.42 \pm 3.11 / 76.78 \pm 1.89$ mm of Hg, similar to Dar et al study(3). The mean serum uric acid levels in the control was 3.94 ± 0.49 mg/dL and in the cases was 5.61 ± 0.41 mg/dL. There was significant elevation in the serum uric acid levels in the cases compared to controls with a p value < 0.05 . Numerous studies have connected hyperuricemia to the emergence of hypertension. According to the Olivetti heart research (7), serum uric acid and the onset of hypertension are positively associated. In their investigation, Selby, et al. (1990) came to the conclusion that the development of hypertension was closely correlated with both forced vital capacity and serum uric acid(8).

A review report by Hayden et al. (2004) stated that in individuals with cardiovascular risk, an elevated serum uric acid levels > 4 mg/dl should be considered as a Red flag(9). Among the cases 55 had diabetes and there is no significant correlation between diabetes and serum uric acid levels in this study, correlated with suganthe,al study(5). In the present study, among the cases, 22 patients had cardiac comorbidities, who also showed significant increase in serum uric acid levels, correlated well with suganthe,al study.

According to the Framingham Heart Study, uric acid plays no causative role in the onset of coronary heart disease or death caused by it. Serum uric acid and cardiovascular disease have been linked, according to an epidemiologic study(10). Additionally, the recent PIUMA study found that elevated serum uric acid is a significant risk factor for developing cardiovascular disease(11). Prolonged and severe hypertension can result in nephrosclerosis causing rise in serum uric acid levels, indicating renal dysfunction(12). As a result, elevated uric acid levels may cause an increase in HTN, and chronic HTN may cause elevated uric acid levels due to renal impairment.

As a result, serum uric acid may be a useful tool for locating people who are at a high risk of developing hypertension illnesses. In a K-MetS study, even with successful treatment with antihypertensives, the BP remain uncontrolled in hypertensive patients with hyperuricemia, highlighting the need to control uric acid levels as a part of BP controlling strategies(4). Still more studies have to be conducted to ascertain the association of elevated serum uric acid in hypertensives and the role of uric acid lowering drugs in controlling hypertension and its associated diseases.

IV. Conclusion:

The study showed a higher serum uric acid levels in hypertensive patients compared to normotensives. There was no variation among males and females in the above association. Diabetes showed no significance association. Patients with cardiac comorbidities showed high serum uric acid levels along with raised blood pressure. So, hyperuricemia can be considered as an important factor in hypertensives and clinician should check it in the early visits as it can be a sign of cardiovascular risks in the future.

References:

- [1]. Mills KT, Stefanescu A, He J. The global epidemiology of hypertension. *Nat Rev Nephrol.* 2020 Apr;16(4):223–37.
- [2]. Borghi C, Agnoletti D, Cicero AFG, Lurbe E, Virdis A. Uric Acid and Hypertension: a Review of Evidence and Future Perspectives for the Management of Cardiovascular Risk. *Hypertension.* 2022 Sep;79(9):1927–36.
- [3]. Dar WR, Gupta SK, Ahmad A. Serum uric acid levels in essential hypertension and its correlation with the severity of hypertension. *Int J Adv Med.* 2020 Oct 21;7(11):1738.
- [4]. Cho J, Kim C, Kang DR, Park JB. Hyperuricemia and uncontrolled hypertension in treated hypertensive patients: K-MetS Study. *Medicine.* 2016 Jul;95(28):e4177.
- [5]. Suganth NG. Study on Serum Uric Acid levels in Essential Hypertension [Internet] [masters]. Madras Medical College, Chennai; 2017 [cited 2022 Oct 24]. Available from: <http://repository-tnmgrmu.ac.in/12019/>
- [6]. Divyen K, Sc A, L SN, Vartika R, Hardik P. Evaluation of Rol of Serum Uric Acid Levels in Cases of Essential Hypertension. *IJCMR* [Internet]. 2018 May [cited 2022 Oct 24];5(5). Available from: https://www.ijcmr.com/uploads/7/7/4/6/77464738/ijcmr_2015.pdf
- [7]. Jossa F, Farinaro E, Panico S, Krogh V, Celentano E, Galasso R, et al. Serum uric acid and hypertension: the Olivetti heart study. *J Hum Hypertens.* 1994 Sep;8(9):677–81.
- [8]. Selby JV, Friedman GD, Quesenberry CP. Precursors of essential hypertension: pulmonary function, heart rate, uric acid, serum cholesterol, and other serum chemistries. *Am J Epidemiol.* 1990 Jun;131(6):1017–27.
- [9]. Hayden MR, Tyagi SC. Uric acid: A new look at an old risk marker for cardiovascular disease, metabolic syndrome, and type 2 diabetes mellitus: The urate redox shuttle. *Nutrition & Metabolism.* 2004;1:10.
- [10]. Muiesan ML, Agabiti-Rosei C, Paini A, Salvetti M. Uric Acid and Cardiovascular Disease: An Update. *European Cardiology Review.* 2016 Aug;11(1):54.
- [11]. Verdecchia P, Schillaci G, Reboldi G, Santeusano F, Porcellati C, Brunetti P. Relation between serum uric acid and risk of cardiovascular disease in essential hypertension. The PIUMA study. *Hypertension.* 2000 Dec;36(6):1072–8.
- [12]. Messerli FH, Frohlich ED, Dreslinski GR, Suarez DH, Aristimuno GG. Serum uric acid in essential hypertension: an indicator of renal vascular involvement. *Ann Intern Med.* 1980 Dec;93(6):817–21.

PuliSampath Benarjee, et. al. “Study of serum Uric acid levels in Essential hypertension – A case control study.” *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 22(1), 2023, pp. 34-36.