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Frequency of Hyperuricemia in Patients with Controlled and Uncontrolled Hypertension

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ABSTRACT

OBJECTIVE: To compare the frequency of hyperuricemia between controlled and uncontrolled hypertensive patients.

METHODOLOGY: A descriptive cross-sectional study was done by the Department of Medicine at Sohail Trust Hospital Karachi, an associated hospital of Jinnah Medical & Dental College, from December 2024 to March 2025. The study employed non-probability consecutive sampling and involved a sample size of 150 participants. Informed consent was taken from those patients who fulfilled the inclusion criteria. All the data were entered in the performa. Data analysis was performed using SPSS version 26.0. The Chi-square test was used to compare hyperuricemia between controlled and uncontrolled hypertensive patients at a 5% level of significance, and a P-value ≤ 0.05 was considered statistically significant.

RESULTS: Mean ± SD of age was 56.11±8.75 years. Mean ± SD of serum uric acid was 7.44±2.27 mg/dl. 112 (74.7%) were male, while 38 (25.3%) were female patients. Controlled hypertension was present in 49 (32.7%), while uncontrolled hypertension was present in 101 (67.3%) patients. Hyperuricemia was found in 107 (71.3%) patients, among them 35 (23.3%) had controlled hypertension, while 72 (48.0%) had uncontrolled hypertension, and the p-value was determined as not statistically significant (P=0.986).

CONCLUSION: Hyperuricemia is highly prevalent in hypertensive patients with an insignificant difference between controlled and uncontrolled hypertension. Further research involving a broader sample size and added parameters is required to establish the statistical significance and strengthen the findings of our study.

KEYWORDS: Hyperuricemia, Hypertension, Controlled Hypertension, Uncontrolled Hypertension, Serum Uric Acid, Prevalence.

INTRODUCTION

Due to the increasing prevalence of hypertension, it has become an essential public health problem[1]. It is also considered one of the significant risk factors for cardiovascular disease, stroke and chronic kidney disease (CKD)[2]. Complications as a result of hypertension contribute to almost one-third of mortality related to cardiovascular diseases[3]. In 2019, 18.5 million cases of hypertension were estimated, with mortality of 1.1 million. From 2000 to 2019, the prevalence of hypertension increased by 0.20% annually[4]. Hypertensive heart disease deaths are more in low- and middle-income countries, with a high proportion of premature deaths in Pakistan[5]. Uncontrolled hypertension is usually referred to as undiagnosed cases or lack of blood pressure (BP) control despite treatment or due to poor compliance with medications; it is still prevalent and seen in approximately 26% cases[6].

Understanding the risk factors of hypertension helps in adequate control and prevention of this disease. Various studies have shown that increased serum uric acid (SUA) levels may act as an independent risk factor for developing pre-hypertension, developing hypertension or resistant hypertension among people of various populations[7,8]. Animal studies have also shown that increased SUA levels caused hypertension among rats[9]. Mechanisms such as activation of the renin angiotensin system (RAS) and endothelial dysfunction related to nitric oxide synthase may be a link between hypertension and hyperuricemia[9,10]. Hyperuricemia is also associated with hypertensive complications by causing target organ damage[11]. Moreover, it is also found that hyperuricemia is associated with increased risk of metabolic syndrome and dyslipidemia[12].

A study reported the frequency of hyperuricemia to be 74.45% in hypertensive patients[13]. Another study has shown that in patients with uncontrolled hypertension, hyperuricemia was found in 18.6% whereas in patients with controlled hypertension, hyperuricemia was found in 14.1%[14].

Our study seeks to define the relationship between hypertension and hyperuricemia without the influence of other confounding factors. Moreover, among patients with controlled hypertension, increased SUA levels may lead to uncontrolled hypertension. So, we decided to compare the frequency of hyperuricemia in controlled versus uncontrolled hypertensive patients as well.

The rationale for studying the frequency of hyperuricemia in patients with controlled and uncontrolled hypertension lies in the well-documented association between elevated SUA levels and hypertension. Understanding its prevalence in patients with controlled versus uncontrolled hypertension can provide insights into the interplay between uric acid levels and blood pressure management. This knowledge can facilitate the identification of at-risk patients and support clinical judgment, and promote targeted interventions to improve outcomes, particularly in populations with poorly managed hypertension, where the risk of complications may be amplified.

METHODOLOGY

A descriptive cross-sectional study was done by the Department of Medicine at Sohail Trust Hospital Karachi, an associated hospital of Jinnah Medical & Dental College Karachi, from December 2024 to March 2025. It involved a sample size of 150 participants, which was estimated through the WHO calculator for sample size by taking the frequency of hyperuricemia (74.45%)[13] in hypertensive patients, Margin of error (d)=7%, Confidence level (C.I) =95%. Controlled hypertension is defined as known hypertensive patients on medication with systolic BP of <140 mmHg and diastolic BP of <90 mmHg, while uncontrolled hypertension is defined as systolic BP ≥140 mmHg and diastolic BP ≥90 mmHg despite medication. Hyperuricemia is defined as SUA of ≥7 mg/dL.

The study employed non-probability consecutive sampling. The study included male and female patients aged 30 to 80 years with either controlled or uncontrolled hypertension. Exclusion criteria included patients with secondary hypertension, those taking anti-tuberculosis drugs, immunosuppressants, chemotherapeutic agents, or aspirin, and those with a prior diagnosis of stroke or chronic renal failure. Patients unwilling to participate were also excluded.

Data collection was started after approval from the institution's ethical review committee. Informed consent was taken from those patients who fulfilled the inclusion criteria, ensuring confidentiality and explaining their right to withdraw at any time. Baseline data, including age, weight, height, body mass index (BMI), and blood pressure, were recorded. A Standiometer and a weighing scale without shoes were used to assess height and weight, respectively. The BMI was calculated as the weight in kilograms divided by the square of the height in meters (kg/m2). A well-calibrated sphygmomanometer was used to measure blood pressure when the patient was comfortable, sitting or supine, with back supported for at least 5 minutes. Blood samples were collected after 8 hours of fasting to measure serum uric acid levels. The analysis was performed using the Cobas c 501 photometric method. Data were recorded on a predesigned proforma, strictly following exclusion criteria to control any bias/confounders.

Data analysis was performed using SPSS version 26.0 (Armonk, NY: IBM Corp. Released 2012). The continuous data was evaluated for normal distribution by using the Shapiro-Wilk test. Descriptive statistics were calculated in the form of Mean ± SD for age, height, weight, BMI, systolic blood pressure, diastolic blood pressure and serum uric acid. Frequency and percentages were calculated for gender, controlled hypertension, uncontrolled hypertension and presence or absence of hyperuricemia. Comparison of hyperuricemia between controlled and uncontrolled hypertensive patients was performed using the Chi-square test at a 5% level of significance. Stratification of age, gender and BMI was done to control effect modifiers. Post-stratification Chi-square tests calculated statistical significance ($p \leq 0.05$).

RESULTS

In our study, 150 patients were evaluated to evaluate the hyperuricemia in patients with hypertension and compare it between controlled and uncontrolled hypertensive patients visiting Sohail Trust Hospital, Karachi and the results were assessed as:
The Shapiro-Wilk test was applied for the distribution of continuous variables for age (P=0.064), weight (P=0.078), height (P=0.099), BMI (P=0.119), systolic blood pressure (P=0.215), diastolic blood pressure (P=0.085) and SUA (P=0.092) as presented in **TABLE I**.

Table I: Descriptive statistics of shapiro-wilk test (n=150)

Variable	Mean±SD	P-value
Age Group	56.11±8.75	0.064
Weight	73.66±10.37	0.078
Height	168.67±8.45	0.099
Body Mass Index	25.93±3.55	0.119
Systolic Blood Pressure	158.35±28.31	0.215
Diastolic Blood Pressure	93.59±12.21	0.085
Serum Uric Acid	7.44±2.27	0.092

The age mean ± SD was 56.11±8.75 with C.I (54.70-57.53) years old. The weight mean ± SD was 73.66±10.37 with C.I (71.99-75.33) kg. The height Mean ± SD was 168.67±8.45 with C.I (167.30-170.03) cm. Mean ± SD of BMI was 25.93±3.55 with C.I (25.35-26.50) kg/m2. Mean ± SD of systolic blood pressure was 158.35±28.31 with C.I (153.78-162.91) mmHg. Mean ± SD of diastolic blood pressure was 93.59±12.21 with C.I (91.62-95.56) mmHg. Mean ± SD of SUA was 7.44±2.27 with C.I (7.07-7.81) mg/dl. In gender distribution, 112 (74.7%) males and 38 (25.3%) females were found. In the distribution of hypertension, controlled hypertension was noted in 49 (32.7%), while uncontrolled hypertension was reported in 101 (67.3%) patients. Hyperuricemia was found in 107 (71.3%) patients. In comparison, hyperuricemia was present in 35 (23.3%) vs 72 (48.0%) patients with controlled and uncontrolled hypertension, having a non-significant p-value (P=0.986) as revealed in **Table II**.

Table II: Comparison of hypertension with hyperuricemia (n=150)

Hypertension	Hyperuricemia		P-value
	Yes	No	
Controlled	35 (23.3%)	14(9.3%)	0.986
Uncontrolled	72(48.0%)	29(19.3%)	

Applied Chi-Square test

After evaluating confounders and effect modifiers concerning hyperuricemia, no significant differences are found among age groups (P=0.585), gender (P=0.646), and BMI (P=0.322).

DISCUSSION

Hyperuricemia is a medical state involving an elevated level of SUA. Uric acid is the final byproduct of the metabolism of purine. The SUA level depends on the intake of purines, the purine metabolism, and the renal and intestinal excretion of urate[15]. The uric acid-binding proteins elevate the physiological solubility from 6 mg/dl to 7.0 mg/dl, which results in uric acid crystallization.

The incidence of hypertension increases as age increases, which in turn results in more morbidity and mortality through several complications such as ischemic heart disease (IHD), heart failure, stroke, peripheral arterial disease and renal failure[16]. In hypertension, 5-10% of patients have an identifiable underlying cause, and it is termed as secondary hypertension, while 90-95% of patients have no identifiable cause and it is termed as essential hypertension[17]. In Pakistan, the incidence of hypertension was found to be 16.2% in the rural and 21.6% in the urban population[18].

Different studies have established the association between SUA and hypertension. One of the Significant contributing factors for developing hypertension is hyperuricemia[19]. It has been recognized that hyperuricemia is also a risk factor for the progression of cardiovascular complications in hypertension[20]. Therefore, the control of hyperuricemia might be critical for hypertensive management. In the management of hypertension, especially with hyperuricemia, it might be crucial to select a drug which does not influence or reduce the concentration of uric acid[20].

Shah SS 2021[13] noted the mean age to be 56.09±09.36 years. Mean SUA level was 6.96 ± 0.82 mg/dl, and the incidence of hyperuricemia in hypertensive patients was 74.45%. In another study, Raja S et al.[21] reported that the overall prevalence of hyperuricemia was 30.1% and 67.3% hypertensive patients also had hyperuricemia. Bhosale A 2022 [22] reported a mean age of 55.02 years and the prevalence of hyperuricemia in hypertensive patients as 27.7%. Rajadhyaksha A 2022[23] stated that 124 from a total of 316 patients with hyperuricemia were found to have hypertension, with SUA in patients with hypertension was 8.28 (±1.23) mg/dl.

In our study, 67.3% had uncontrolled hypertension. Farhadi F et al.[24] reported that the frequency of uncontrolled hypertension out of all the participants was 61.7%. Amare F 2020[25] noted that the incidence of uncontrolled hypertension is 48%.

In the current study, in comparison, hyperuricemia was found in 35 (23.3%) and 72 (48.0%) patients with controlled and uncontrolled hypertension, having a non-significant P-value (P=0.986). There are only a few studies about the prevalence of hyperuricemia in uncontrolled hypertension. Liu C et al.[26] reported that hyperuricemia was associated with a high risk of sustained uncontrolled hypertension. The study of Cho J 2016[14] found an average age of 56.1±10.5 years. It has been shown that in patients with uncontrolled hypertension, hyperuricemia was found in 18.6% whereas in patients with controlled hypertension, hyperuricemia was found in 14.1%[14]. Borghi C et al.[27] stated that high SUA levels are associated with an increased risk of developing uncontrolled hypertension. Cicero AF et al.[28] concluded that raised SUA levels were also associated with resistance to antihypertensive treatment.

These studies show that there is a higher prevalence of hyperuricemia in our region, which may lead to uncontrolled hypertension. However, only a few studies focus on the comparison of controlled and uncontrolled hypertension. More studies are required to establish the association and to determine a management plan.

CONCLUSION

There is a high prevalence of hyperuricemia among hypertensive patients; however, no significant difference was found between controlled and uncontrolled hypertension in our study. Further research involving a broader sample size and added parameters in various study centers is required to establish the statistical significance and strengthen the findings of our research.

Ethical Permission: Jinnah Medical & Dental College, Karachi, Pakistan, ERC letter No. 00099/24.
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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Jaweid T: Concept, study design, data analysis.
Razzaq S: Editing and critical revision of manuscript.
Kumar A: Concept, supervision and critical revision of manuscript.
Khan MM: Writing of manuscript.
Zaib F: Data analysis.

REFERENCES

1. Melgarejo ID, Maestre GE, Thijs L, Asayama K, Boggia J, Casiglia E et al. Prevalence, Treatment, and control rates of conventional and ambulatory hypertension across 10 Populations in 3 Continents. Hypertension. 2017; 70(1): 50-8. doi:10.1161/HYPERTENSIONAHA.117.09188
2. Zhou B, Perel P, Mensah GA, Ezzati M. Global epidemiology, health burden and effective interventions for elevated blood pressure and hypertension. Nat Rev Cardiol. 2021; 18(11): 785–802. doi: 10.1038/s41569-021-00559-8.
3. Wang C, Yuan Y, Zheng M, Pan A, Wang M, Zhao M et al. Association of age of onset of hypertension with cardiovascular diseases and mortality. J Am Coll Cardiol. 2020; 75(23): 2921–2930. doi:10.1016/j.jacc.2020.04.038.
4. Chew NWS, Ng CH, Tan DJH, Kong G, Lin C, Chin YH et al. The global burden of metabolic disease: Data from 2000 to 2019. Cell Metab. 2023; 35: 414–428. doi:10.1016/j.cmet.2023.02.003.
5. Lu WL, Yuan JH, Liu ZY, Su ZH, Shen YC, Li SJ et al. Worldwide trends in mortality for hypertensive heart disease from 1990 to 2019 with projection to 2034: data from the global burden of disease 2019 study. Eur J Prev Cardiol. 2024; 31(1): 23–37. doi:10.1093/eurjpc/zwad262
6. Kario K, Okura A, Hoshide S, Mogi M. The WHO Global report 2023 on hypertension warning the emerging hypertension burden in globe and its treatment strategy. Hypertens Res. 2024; 47: 1099–1102. doi:10.1038/s41440-024-01622-w.
7. Soletsky B, Feig DI. Uric acid reduction rectifies pre-hypertension in obese adolescents. Hypertension. 2012; 60(5): 1148-56. doi:10.1161/HYPERTENSIONAHA.112.196980.
8. Beattie CJ, Fulton RL, Higgins P, Padmanabhan S, McCallum L, Walters MR et al. Allopurinol initiation and change in blood pressure in older adults with hypertension. Hypertension. 2014; 64(5): 1102-7. doi:10.1161/HYPERTENSIONAHA.114.03953.
9. Mazzali M, Hughes J, Kim YG, Jefferson JA, Kang DH, Gordon KL et al. Elevated uric acid increases blood pressure in the rat by a novel crystal-independent mechanism. Hypertension. 2001; 38(5): 1101-6. doi:10.1161/hy1101.092839.
10. Kang DH, Park SK, Lee IK, Johnson RJ. Uric acid-induced C-reactive protein expression: implication on cell proliferation and nitric oxide production of human vascular cells. J Am Soc Nephrol. 2005; 16(12): 3553-62. doi:10.1681/ASN.2005050572.
11. 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; 79(9): 1927-36. doi:10.1161/HYPERTENSIONAHA.122.17956
12. Shahid R, Hussain M, Ghori MU, Bilal A, Awan FR. Association of hyperuricemia with metabolic syndrome and its components in an adult population of Faisalabad, Pakistan. Nutr Metab Cardiovasc Dis. 2024; 34(6): 1554–8. doi:10.1016/j.numecd.2024.03.017
13. Shah SS, Iqbal U, Ahmad E. Frequency of hyperuricemia in hypertensive patients and its association with age of patient. Pak Armed Force Med J. 2021; 71(1): 304-8. doi:10.51253/pafmj.v71i1.2808.
14. Cho J, Kim C, Kang DR, Park JB. Hyperuricemia and uncontrolled hypertension in treated hypertensive patients: K-MetS Study. Medicine (Baltimore). 2016; 95(28): e4177. doi:10.1097/MD.0000000000004177
15. Gustafsson D, Unwin R. The pathophysiology of hyperuricaemia and its possible relationship to cardiovascular disease, morbidity and mortality. BMC Nephrol. 2013; 14(1): 1-9. doi:10.1186/1471-2369-14-164.
16. Doyle AE. Hypertension and vascular disease. Am J Hypertens. 1991; 4(2_Pt_2): 103S-6S. doi:10.1093/ajh/4.2.103s.
17. Charles L, Triscott J, Dobbs B. Secondary hypertension: discovering the underlying cause. Am Fam Physician. 2017; 96(7): 453-61

18. Bobulescu IA, Moe OW. Renal transport of uric acid: evolving concepts and uncertainties. Adv Chronic Kidney Dis. 2012; 19(6): 358–71. doi:10.1053/j.ackd.2012.07.009.
19. Kuwabara M. Hyperuricemia, cardiovascular disease, and hypertension. Pulse. 2016; 3(3-4): 242-52. doi:10.1159/000443769.
20. Ito H, Antoku S, Furusho M, Shinozaki M, Abe M, Mifune M et al. The prevalence of the risk factors for atherosclerosis among type 2 diabetic patients is greater in the progressive stages of chronic kidney disease. Nephron Extra. 2013; 3(1): 66–72. doi:10.1159/000353592.
21. Raja S, Kumar A, Aahooja RD, Thakuria U, Ochani S, Shaukat F. Frequency of hyperuricemia and its risk factors in the adult population. Cureus. 2019; 11(3): e4198. doi:10.7759/cureus.4198.
22. Bhosale A, Khedkar S, Khade SK, Reddy MM. Study of serum uric acid levels in essential hypertension. Int J Health Sci (Qassim). 2022; 6(S7): 3528-36. doi:10.53730/ijhs.v6nS7.12511.
23. Rajadhyaksha A, Sarate N, Raghorte N, Ingawale S. A clinical profile of patients with hyperuricemia and the relationship between hyperuricemia and metabolic syndrome: a cross-sectional study at a tertiary hospital in the Indian population. J Assoc Physicians India. 2022 May; 70(5): 11-2. doi:10.0102/japi.2022.05.
24. Farhadi F, Aliyari R, Ebrahimi H, Hashemi H, Emamian MH, Fotouhi A. Prevalence of uncontrolled hypertension and its associated factors in 50–74 years old Iranian adults: a population-based study. BMC Cardiovasc Disord. 2023; 23: 318. doi:10.1186/s12872-023-03357-x.
25. Amare F, Hagos B, Sisay M, Molla B. Uncontrolled hypertension in Ethiopia: a systematic review and meta-analysis of institution-based observational studies. BMC Cardiovasc Disord. 2020 Dec; 20: 1-9. doi:10.1186/s12872-020-01414-3.
26. Liu C, Qiu D, Zhang M, Hou J, Lin J, Liao H. Association of hyperuricemia and hypertension phenotypes in hypertensive patients without uric acid-lowering treatment. Clin Exp Hypertens. 2021; 43(6): 516-21. doi:10.1080/10641963.2021.1907397.
27. Borghi C, Tubach F, De Backer G, Dallongeville J, Guallar E, Medina J et al. Lack of control of hypertension in primary cardiovascular disease prevention in Europe: results from the EURIKA study. Int J Cardiol. 2016; 218: 83–88. doi:10.1016/j.ijcard.2016.05.044
28. Cicero AF, Rosticci M, Fogacci F, Grandi E, D'Addato S, Borghi C, Brisighella Heart Study Group. High serum uric acid is associated to poorly controlled blood pressure and higher arterial stiffness in hypertensive subjects. Eur J Intern Med. 2017; 37: 38–42. doi:10.1016/j.ejim.2016.07.026.