

Association of Asymptomatic Hyperuricemia with Blood Pressure in Different Age Groups in Semiurban Population of Karachi

Adil Khan, Dania Faisal and Beena Khan

Asymptomatic
Hyperuricemia
with Blood
Pressure in
Different Age

ABSTRACT

Objective: To study association between serum uric acid level and hypertension in different age groups of semiurban population of Karachi.

Study Design: Cross sectional study

Place and Duration of Study: This study was conducted at the Department of Medicine, Fatima Hospital, Baqai Medical University Karachi from 15th December 2022 to 15th February 2023.

Materials and Methods: 366 participants aged more than 40 years were enrolled in the study. It was ensured participants were not using any drug that may affect serum uric acid level and were not suffering from any comorbid condition like liver or kidney disease that may increase serum uric acid level. After a brief physical examination blood sample was sent for serum uric acid and lipid profile. Appropriate statistical test was used to find association of serum uric acid and blood pressure readings.

Results: Serum uric acid level ($p = 0.046$), Systolic blood pressure ($p=0.006$) and diastolic blood pressure ($p=0.032$) were significantly high in participants aged more than 60 years. Prevalence of hypertension was higher among participants with hyperuricemia as compared to participants with normal uric acid level. (65% vs 52.14%, $p = 0.021$).

Conclusion: Hyperuricemia is associated with increased prevalence of hypertension.

Key Words: Hypertension, Hyperuricemia, uric acid level

Citation of article: Khan A, Faisal D, Khan B. Association of Asymptomatic Hyperuricemia with Blood Pressure in Different Age Groups in Semiurban Population of Karachi. Med Forum 2023;34(7):116-119. doi:10.60110/medforum.340727.

INTRODUCTION

The prevalence of hyperuricemia is increasing in many countries. Hyperuricemia is defined as blood uric acid level that is greater than 7 mg/dl in males and 6 mg/dl in females. The concept of association between hyperuricemia with GOUT and renal involvement has been subject to significant transformation much earlier.¹ Hyperuricemia that does not manifest clinically is referred to by the term "asymptomatic hyperuricemia". Researchers have found that hyperuricemia also has association with an increased risk of cardiovascular disorders including hypertension. It is a well-known fact that those who have hypertension are at a greater risk of developing hyperuricemia.

However, recent research has demonstrated that hyperuricemia can also be an independent predictor of hypertension, with an approximately twofold increased risk at 5 to 10 years.² Studies suggest that, the relationship between hyperuricemia and blood pressure may be different in people of different ages. It was reported that hyperuricemia was associated with blood pressure in the population of non-elderly Koreans, but it was interesting to find that this relationship was not significant among the elderly.³ The presence of hyperuricemia was found to have an independent association with hypertension in Chinese males under the age of 60. This appears somewhat different, as both hypertension and hyperuricemia are thought to be more prevalent among the elderly, but that there is a strong association between the two in younger people in different populations.⁴ According to the findings of the National Health and Nutrition Examination Survey, a serum uric acid concentration of >5.5 mg/dl was related with a risk of hypertension that was two times higher than average. Additionally, the survey found that the risk of hypertension increased by 38% with every 0.1mg/dl increase in serum uric acid concentration in people aged 12 to 17 years old.⁵ On the other hand, association between hypertension and hyperuricemia was significantly stronger among Japanese people elder than 40 years.⁵ This suggests that the association

Department of Medicine, Baqai Medical University, Karachi.

Correspondence: Adil Khan, Associate Professor of Medicine, Baqai Medical University, Karachi.

Contact No: 0321-2578761

Email: adil_dr_dow@hotmail.com

Received: March, 2023

Accepted: April, 2023

Printed: July, 2023

between serum uric acid level and hypertension is not the same across all age groups, and that the nature of this relationship differs from one population to another.⁶ To the best of our knowledge, relationship between serum uric acid and hypertension in different age groups, previously has not been studied locally. Therefore, in order to contribute to the literature, we aimed to study relationship between serum uric acid level and hypertension in different age groups in semi urban population of Karachi.

MATERIALS AND METHODS

Sample Size: Sample size was calculated using Open Epi, a free access online software. Considering 39% prevalence of hyperuricemia in Pakistani population(7), a sample size of at least 366 people was determined, with a 5% likelihood of Type I error.

Study Population: Patients over the age of 40 who visited the outpatient department of the Department of Medicine at Fatima Hospital, Baqai Medical University, Karachi from 15th December 2022 to 15th of February 2023 were enrolled as study participants for this cross sectional study. Participants were not included in study if they were using drugs which may affect uric acid level like diuretics, allopurinol, febuxostat, immunosuppressants, fenofibrate, cytotoxic chemotherapy, and anti-tubercular medications, were having child-pugh class C chronic liver disease or were having chronic renal disease whose eGFR is less than 60 ml per minute per 1.73 m². Study idea was given approval by ethics committee, Baqai Medical University, Karachi and written informed consent was obtained from all participants.

Data Collection: Participant's age, sex, co-morbid states and drug history was recorded using a self-reporting proforma. A professional staff member measured blood pressure using conventional mercury sphygmomanometer. Blood pressure was measured in both arms after patient had rested for at least 10 minutes and making sure participant did not smoke tobacco or consumed caffeine at least 30 minutes before measurement.

Antecubital vein was used to collect blood samples, which were then analyzed for biochemical values. They comprised total cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL-C), low density lipoprotein (LDL-C), alanine transaminase (ALT), serum creatinine, serum uric acid (SUA), and random

blood glucose (RBS) level. The chronic kidney disease epidemiology collaboration's (CKD-EPI) creatinine cystatin equation was applied to calculate the estimated glomerular filtration rate (eGFR).

Data Analysis:

Data analysis was done using SPSS version 22. Categorical variables were presented as frequency and proportion and for statistical significance, the chi-square test was used. Shapiro Wilk test was used to determine normality of continuous variable. Normally distributed data were presented as mean (\pm SD - standard deviation) and were examined with an independent t-test. Non-normally distributed data were expressed as median (IQR: Inter-quartile range) and were analyzed using the Mann-Whitney U-test. Statistical significance was taken as $p < 0.05$. Binary logistic regression was performed to explore association of hyperuricemia with hypertension.

RESULTS

Table 1 provides a summary of the general characteristics of the 366 individuals in the study. The participants were divided into two groups: those aged 40 to 60 (n=264) and those aged 60 and more (n=102). The following measures showed a statistically significant difference between the groups: systolic blood pressure (SBP), diastolic blood pressure (DBP), serum uric acid (SUA), total cholesterol (TC), LDL cholesterol (LDL-C), and triglyceride level.(Table 1)

The prevalence of hypertension was found to rise with advancing age. The prevalence of hypertension was considerably greater in those above the age of 60 years old (56%) compared to those between the ages of 40 and 60 years old (20.48%, $P=0.021$; Table 2). A similar pattern was seen with the elevated levels of uric acid. The prevalence of hyperuricemia was substantially greater in the age group of over 60 years old (28.9%), compared to the age group of 40 to 60 years old.(17.3%, P value of 0.028; Table 2)

It was found that those who had hyperuricemia had a considerably higher prevalence of hypertension than those people who had normal uric acid levels (65% vs. 52.41%, $p = 0.023$). Binary logistic regression analysis suggested that hyperuricemia was significantly associated with hypertension (odds ratio 0.564 95% confidence interval (CI), 0.347-0.918, $p=0.021$) in whole cohort.

Table No. 1: General characteristics of participants.

Variable	Total(366)	40 – 60 year(264)	>60years(102)	P
N(male:female)	237:129	179:85	58:44	0.686
Age	54(11)	50(12)	65(4)	<0.001
SBP	130.85 \pm 12.82	128.40 \pm 14.82	138.20 \pm 6.33	0.006
DBP	78.85 \pm 9.72	76 \pm 9.96	81.40 \pm 8.93	0.032
SUA	5.35 \pm 0.85	5.19 \pm 0.76	5.84 \pm 1.98	0.046
TC	165(24)	165(26)	171(35.5)	0.06

LDL-C	87.73±8.94	84.85±14.40	88.48±13.81	0.037
HDL	39.62±8.93	40.57±9.40	36.10±6.70	0.116
TG	133.67±58.76	134.07±65.95	173.87±60.17	0.018

Table No. 2: Prevalence of hypertension and hyperuricemia in different age groups.

Variable	Total	40 – 60 years(n=264)	>60 years(n=102)	p
Hypertension	205(55.6%)	42(20.48%)	163(56%)	0.021
Hyperuricemia	97(26.3%)	13(17.3%)	84(28.9%)	0.028

DISCUSSION

Our study explored the association between hyperuricemia and hypertension. The prevalence of hypertension was shown to be higher among people who had hyperuricemia, according to our findings. This relationship was statistically significant among young individuals as well.

Our study found that the prevalence of hypertension was significantly greater in those who had hyperuricemia than people whose uric acid levels were normal (65% vs. 52.41%, $p = 0.023$). Although the idea of association between hypertension and hyperuricemia is not new, in the recent years, fresh epidemiological research have reignited an interest in this association. This is despite the fact that the concept of a relationship between the two is rather ancient. An high blood uric acid level was found to be an independent risk factor for hypertension in the Chinese population after being investigated in a large study that included 7482 participants and had a mean follow-up period of four years.⁸ The incidence of hypertension was found to be highest in the group that had the highest amount of uric acid, according to a more recent study that was conducted by Lee JJ et al.³ This effect was more pronounced among non-elderly females. According to the findings of the Bogalusa heart study, higher levels of hyperuricemia in younger people and older children were linked to an increased risk of developing hypertension. Given that biochemical metabolic disorders like hyperuricemia and dyslipidemia are typically screened in elderly patients, this raises a significant worry regarding the need of controlling blood uric acid level at an early age. This also indicates that genetics have a significant influence in metabolic disorders such as hyperuricemia, in addition to the lifestyle choices and habits.

Renal insufficiency is associated with hyperuricemia and has well established mechanism of hypertension.⁹ Therefore, patients who had renal insufficiency, which was defined as an eGFR < 60 ml/min/1.73 m², were excluded from the study. Similarly, there is a significant association between liver disease and hyperuricemia,¹⁰ hence, participants who had child-pugh class III chronic liver disease were also excluded from the study. Therefore, our study results are not affected in any way by the presence of concurrent liver or renal disease.

According to studies, the association between high serum uric acid levels and hypertension may be age-

related. According to the findings of a study that inducted 45098 Korean participants, hypertension and hyperuricemia were significantly associated among men and women younger than 60 years of age.³ On the other hand, a study that was conducted on the Chinese population and included 8469 participants revealed that hypertension and hyperuricemia were significantly associated with one another among middle-aged men and elderly females. The other astounding discovery made by this study was that the relationship between hypertension and hyperuricemia is much stronger in people who are not obese than in people who are obese.¹¹ This demonstrates that we may get different outcomes in relation to the uric acid levels in various ethnic groups. Is it the ethnicity is the only factor that affects serum uric acid levels and behavior, or may there be additional factors at play? When it comes to carrying out research on uric acid, Kuwabara M et al believe that many pitfall exist.¹² Serum uric acid level can be affected by a wide variety of factors, ranging from lifestyle and body habits to comorbidities. Our study also shows that hyperuricemia prevalence is increasing among non-elderly.

In recent years, the relationship between serum uric acid levels and a different metabolic and cardiovascular problems has been the subject of extensive research and discussion. The presence of high uric acid levels in the serum is thought to be a predictor of a variety of metabolic and cardiovascular problems even before these conditions have manifested themselves. During the six year follow-up of the Gubbio Study, increased blood uric acid levels were independently and significantly related with an increased risk of cardiovascular disease events.¹³ Grossman C et al observed that the serum uric acid level is an independent predictor of coronary artery disease in midlife.¹⁴ The association of uric acid levels with problems is not limited to cardiovascular diseases; rather, it encompasses a large list of conditions that also includes renal disorders, response after transplant, response after surgery, and fatty liver disease.^{15,16} It remains an important concern to control uric acid level at an early age to get protected from different disorders. There is a need for genetic research on large scale in order to investigate the uneven or varied behavior of uric acid levels.

CONCLUSION

The study shows persistent hyperuricemia is associated with increased incidence of hypertension. This relationship could be more important in younger population. Early detection and treatment of hyperuricemia could protect against hypertension.

Author's Contribution:

Concept & Design of Study: Adil Khan
 Drafting: Dania Faisal
 Data Analysis: Beena Khan
 Revisiting Critically: Adil Khan, Dania Faisal
 Final Approval of version: Adil Khan

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

- Butler F, Alghubayshi A, Roman Y. The epidemiology and genetics of hyperuricemia and gout across major racial groups: a literature review and population genetics secondary database analysis. *J Personalized Med* 2021;11(3):231.
- Gaubert M, Bardin T, Cohen-Solal A, Diévert F, Fauvel JP, Guieu R, et al. Hyperuricemia and hypertension, coronary artery disease, kidney disease: from concept to practice. *Int J Molecular Sci* 2020;21(11):4066.
- Lee JJ, Ahn J, Hwang J, Han SW, Lee KN, Kim JB, et al. Relationship between uric acid and blood pressure in different age groups. *Clinical Hypertension* 2015;21(1):1-7.
- Cheng W, Wen S, Wang Y, Qian Z, Tan Y, Li H, et al. The association between serum uric acid and blood pressure in different age groups in a healthy Chinese cohort. *Medicine* 2017;96(50).
- Loeffler LF, Navas-Acien A, Brady TM, Miller III ER, Fadrowski JJ. Uric acid level and elevated blood pressure in US adolescents: National Health and Nutrition Examination Survey, 1999–2006. *Hypertension* 2012;59(4):811-7.
- Zahir FR. Editorial on the Paper “The Epidemiology and Genetics of Hyperuricemia and Gout across Major Racial Groups: A Literature Review and Population Genetics Secondary Database Analysis” by Butler, Alghoubayshi and Roman. *J Personalized Med* 2022;12(8):1331.
- Qudwai W, Jawaid M. Frequency of uric acid levels symptomatic and asymptomatic hyperuricemia among the Pakistani population. *Mid East J Fam Med* 2017;15:52-7.
- Dong J, Hu LK, Lu YK, Liu YH, Chu X, Yan YX. Association of serum uric acid with the risk of developing hypertension: A prospective cohort study with mediation analysis. *Hypertension Res* 2023;46(2):345-56.
- Yang B, Xin M, Liang S, Xu X, Cai T, Dong L, et al. New insight into the management of renal excretion and hyperuricemia: Potential therapeutic strategies with natural bioactive compounds. *Frontiers Pharmacol* 2022;13:1026246.
- Yen PC, Chou YT, Li CH, Sun ZJ, Wu CH, Chang YF, et al. Hyperuricemia Is Associated with Significant Liver Fibrosis in Subjects with Nonalcoholic Fatty Liver Disease, but Not in Subjects without It. *J Clin Med* 2022;11(5):1445.
- Han Y, Han K, Han X, Yin Y, Di H, Wu J, et al. Serum uric acid might be positively associated with hypertension in Chinese adults: an analysis of the China health and nutrition survey. *Frontiers Med* 2022;8:2740.
- Kuwabara M, Kanbay M, Hisatome I. Tips and pitfalls in uric acid clinical research. *Hypertension Res* 2023;46(3):771-3.
- Puddu PE, Lanti M, Menotti A, Mancini M, Zanchetti A, Cirillo M, et al. Serum uric acid for short-term prediction of cardiovascular disease incidence in the Gubbio population Study. *Acta cardiologica* 2001;56(4):243-51.
- Grossman C, Grossman E, Goldbourt U. Uric acid variability at midlife as an independent predictor of coronary heart disease and all-cause mortality. *PLoS One* 2019;14(8):e0220532.
- Maloberti A, Quarti-Trevano F, Dell’Oro R, Facchetti R, Mancina G, Grassi G. Factor Associated with Hyperuricemia Development During A 25 Years Follow-Up: The Pamela Study. *J Hypertension* 2023;41(Suppl 3):e22.
- Shen Y, Wang Y, Chang C, Li S, Li W, Ni B. Prevalence and risk factors associated with hyperuricemia among working population at high altitudes: a cross-sectional study in Western China. *Clin Rheumatol* 2019;38:1375-84.