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Original

Serum uric acid-reduction and blood pressure changes in allopurinol administered hemodialysis patients; a pilot study

Saeed Mardani[1], Hossein Mardanparvar[2], Mahnaz Momenzadeh[3*], Seyedeh Fatameh Nourbakhsh Rezaiee[1], Mohammad Reza Hajian[3]

Abstract

Introduction: Hypertension is one of the most common diseases and is the main cause of disability and mortality worldwide. Hyperuricemia has been recognized as one of the main causes of hypertension; however, few studies have been conducted to determine the correlation between serum uric acid reduction and blood pressure changes.

Objective: This study aimed to assess the correlation between serum uric acid-reduction and blood pressure changes in a group of hemodialysis patients.

Patients and Methods: This descriptive-analytical study was conducted on 21 hemodialysis patients taking allopurinol for the first time. Serum uric acid, systolic blood pressure, and diastolic blood pressure were measured before taking allopurinol, then patients were followed for two months, and these parameters were remeasured. Data were collected and the correlation between serum uric acid-reduction and blood pressure changes was evaluated.

Results: Most patients were female, with a mean age of 56.81 ± 15.59 years. Results showed that the correlation between serum uric acid reduction and blood pressure changes was statistically significant with a ratio of 3.6 reduction for systolic blood pressure and 2.17 for diastolic blood pressure per one unit of uric acid reduction ($P<0.05$).

Conclusion: Uric acid reduction is correlated with blood pressure reduction with both systolic and diastolic blood pressures.

Keywords: Hypertension, Uric acid, Hyperuricemia, Allopurinol

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Introduction

Hypertension is one of the most common diseases and the main cause of disability and mortality worldwide since its mortality is estimated to be 6% (1). The most common risk factors for this disease are age, gender, race, and environmental factors. Previous studies showed a significant association between blood pressure with its prevalence and increasing rate with age in different countries and populations (2).

Uric acid results from purine metabolism and approximately two-thirds of it is excreted through the kidneys. An increase in uric acid level can result in an increase in its production or a decrease in excretion (3-5). Hyperuricemia is one of the components of metabolic syndrome, while its manifestation is one of the indications for screening and treatment for other comorbidities such as obesity, hyperlipidemia, diabetes, and hypertension (6). Hyperuricemia is also one of the most common risk factors for renal injury and cardiac disease (7).

Serum uric acid has a role in Hypertension pathogenesis, since increasing in serum uric acid has been found in one-fourth of untreated hypertensive patients (8). The correlation between serum uric acid and hypertension has been investigated in previous studies; while a study in the United States (9), a study in Thailand (10), and a meta-analysis by Qu et al (11) reported the association between hypertension and serum uric acid. Additionally, a review study stated that the reduction of uric acid led to the normalization of blood pressure in 4 out of 5 hypertensive patients (12).

Objective

In this study, we investigated the correlation between serum uric acid reduction and blood pressure changes in hemodialysis patients who consumed allopurinol for the first time in a two-month period.

Methods and Materials

Study design and participants

This descriptive-analytical and prospective observational

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[1]Department of Internal Medicine, Shahrekord University of Medical Sciences, Shahrekord, Iran. [2]Department of Nursing, Faculty of Nursing and Midwifery, Hormozgan University of Medical Sciences, Bandar Abbas, Iran. [3]Nickan Research Institute, Isfahan, Iran.
***Corresponding author:** Mahnaz Momenzadeh, Email: Mahnazmomenzadehf@gmail.com, Mahnaz.momenzadeh@pharm.mui.ac.ir

Implication for health policy/practice/research/medical education

In a descriptive-analytical study on 21 allopurinol-administered hemodialysis patients, we found a statistically significant direct correlation between serum uric acid reduction and blood pressure changes with a ratio of 3.6 reduction for systolic blood pressure and 2.17 for diastolic blood pressure per one unit of uric acid reduction.

study was conducted on 21 allopurinol-consumed hemodialysis patients referred to Hajar hospital in Shahrekord, Iran. Hemodialysis patients taking allopurinol for the first time were included in the study. Inclusion criteria included taking allopurinol for the first time, having informed consent, and cooperating until the end of the study duration. Exclusion criteria included patients who administrated anti-hypertensive drugs and lack of uric acid and blood pressure measurements at the end of the study. It should be mentioned that patients with acute conditions such as heart attack and stroke were not included. Serum uric acid, systolic blood pressure, and diastolic blood pressure were measured before taking allopurinol, then patients were followed for two months, and these parameters were remeasured. Data was collected, and the association between serum uric acid reduction and blood pressure changes was evaluated.

Data collection

Before the study, demographic characteristics were collected, and serum uric acid was measured by the laboratory using a venous blood sample and recorded. To measure blood pressure, on the day before the start of the study, the patient's blood pressure was measured from all four organs four times at an interval of six hours, and their mean blood pressure was considered as the patient's blood pressure at the time before the study. Patients continued to take allopurinol (100 mg/daily) for two months. After this period, the amount of serum uric acid and the average blood pressure of these patients were measured again and recorded. The serum uric acid and blood pressure mean differences before and after the study were calculated, and the correlation between serum uric acid and blood pressure was assessed.

Statistical analysis

Data were collected and analyzed by Statistical Package for the Social Sciences (SPSS) version 24. The results for quantitative data were reported as mean ± standard deviation or as a median (third quartile–first quartile) and for qualitative data as frequency (percentage). The Kolmogorov-Smirnov test was conducted to assess the data normality distribution. Paired *t* test and Wilcoxon test were conducted to compare the data before and two months after. Accordingly, *P* value of <0.05 was considered significant.

Results

Regarding demographic characteristics, most participants were female, with an average weight and age of 64.1 ± 15.37 kg and 56.81 ± 15.59 years, respectively (Table 1).

Results demonstrated that after two months of taking allopurinol, all variables, including systolic blood pressure, diastolic blood pressure, and serum uric acid reduced significantly. The correlation between serum uric acid reduction and blood pressure changes was statistically significant with a ratio of 3.6 reduction for systolic blood pressure and 2.17 for diastolic blood pressure per one unit of uric acid reduction (Table 2).

Discussion

In this study, serum uric acid level, systolic blood pressure, and diastolic blood pressure decreased two months after the beginning of allopurinol administration. The correlation between serum uric acid reduction and

Table 1. Demographic characteristics of the participating patients

	Mean	Max	Min
Age (y), Mean ± SD	56.81±15.59	80	28
Weight (kg), Mean ± SD	64.1±15.37	96	49
Gender, No. (%)			
Male	5 (23.8)		
Female	16 (76.2)		

Table 2. The systolic blood pressure, diastolic blood pressure, and serum uric acid at baseline and after two months of allopurinol taking

Variable	Baseline Mean ± SD	After two months Mean ± SD	Mean difference Mean ± SD	Odds ratio to uric acid	*P* value
Serum uric acid (mg/dL)	8.29 ± 1.43	4.99 ± 0.76	-3.3 ± 1.6	1	<0.001*
Systolic blood pressure (mm Hg)	144.76 ± 11.18	132.86 ± 13.41	-11.9 ± 12.75	3.60	0.001*
Diastolic blood pressure (mm Hg)	88.38 ± 6.03	81.19 ± 6.01	-7.19 ± 6.02	2.17	<0.001**

* Wilcoxon test, ** Paired *t* test.

blood pressure changes was statistically significant with a ratio of 3.6 reduction for systolic blood pressure and 2.17 for diastolic blood pressure per one unit of uric acid reduction. The reduction of serum uric acid and blood pressure during the study can be attributed to the effect of allopurinol administration because patients have shown a significant decrease in these parameters during two months of allopurinol administration. Consistent with our study, Satirapoj et al stated that, allopurinol treatment reduced serum uric acid and blood pressure significantly twelve weeks after the beginning (10). A meta-analysis study demonstrated that uric acid-lowering therapy by allopurinol is associated with decreased blood pressure (11). Talaat and el-Sheikh during a study, revealed that a significant increase in blood pressure was observed after 12 months of discontinuation of allopurinol for patients with stage 3 and 4 of chronic renal failure, who were previously treated with allopurinol for mild hyperuricemia (13). A previous study in Turkey showed that hyperuricemia is associated with hypertension, and the treatment of hyperuricemia can decrease blood pressure (14).

Previous literature demonstrated that serum uric acid is an independent risk factor for kidney injury, especially in patients with hypertension (15,16). Some studies reported that hypertension is associated with endothelial cell dysfunction, and high serum uric acid is a powerful predictor of hypertension induction and progress (17).

In the current study, a statistically significant correlation was observed between uric acid reduction and changes in blood pressure; in line with our results. Most of the previous studies reported that blood pressure reduction caused by the administration of allopurinol is due to its effect on uric acid reduction, and stated that the mechanism of blood pressure reduction by allopurinol is a decrease in serum uric acid.

Conclusion

Uric acid reduction is associated with blood pressure reduction in both systolic and diastolic blood pressures with a ratio of 3.6 reduction for systolic blood pressure and 2.17 for diastolic blood pressure per each unit of uric acid reduction.

Limitations of the study

This is a pilot study. Our results require further investigations by larger population samples.

Authors' contribution

Conceptualization: SM, MM and SFNR.
Methodology: HM and SFNR.
Validation: SM, MM and SFNR.
Formal analysis: HM.
Investigation: SFNR.
Resources: SFNR, MM and SM.
Data curation: MM and SM.
Writing–original draft preparation: SM, MM and SFNR.
Writing–review and editing: MRH, HM and MM.
Visualization: SM and MM.
Supervision: SM.
Project administration: MM.

Conflicts of interest

The authors declare that there is no conflict of interest.

Ethical issues

The research followed the tenets of the Declaration of Helsinki. The Ethics Committee of Shahrekord University of Medical Sciences approved this study (Ethical code #IR.SKUMS.REC.1390.926). Accordingly, written informed consent was taken from all participants before any intervention. This study was extracted from M.D., thesis of Seyedeh Fatameh Nourbakhsh Rezaiee at this university (Thesis #926). Besides, the authors have ultimately observed ethical issues (including plagiarism, data fabrication, and double publication).

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