Araştırma Makalesi (Research Article)

Serum Uric Acid Levels in Hypertensive Patients Admitted to The Emergency Department

Acil Servise Başvuran Hipertansif Hastalarda Serum Ürik Asit Düzeyleri

Canan AKMAN[1], Serkan BAKIRDOGEN[2]

[1] Canakkale Onsekiz Mart University, School of Medicine, Department of Emergency Medicine, Canakkale, Turkey
[2] Canakkale Onsekiz Mart University, School of Medicine, Department of Internal Medicine, Division of Nephrology, Canakkale, Turkey

Özet

Amaç: Hipertansif acil hastalarda serum ürik asit düzeylerinin önemi konusunda literatürde yeterli bilgi yoktur. Çalışmamız, yüksek tansiyon nedeniyle acil servise başvuran hastalarda serum ürik asit düzeylerinin rolünü araştırmayı amaçlamaktadır.

Gereç ve yöntemler: Kan basıncı 180/110 mmHg ve üzerinde akut hedef organ hasarı olan hipertansif acil hastaları (grup I), kan basıncı 180/110 mmHg ve üzerinde olan akut hedef organ hasarı olmayan hipertansif acele hastaları (grup II) ve sistolik kan basıncı 140-180 mmHg arasında, diyastolik kan basıncı 90-110 mmHg arasında olan kontrolsüz hipertansiyonu olan hastalar (grup III) çalışmaya alındı.

Bulgular: Yüz yirmi dört hipertansif hasta (80 kadın, 44 erkek) çalışmaya dahil edildi. Grup I'de 33 (%26.6), grup II'de 19 (% 15.3) ve grup III'te 72 (%58.1) hasta yer aldı. Serum ürik asit düzeyi açısından karşılaştırıldığında gruplar arasında istatistiksel olarak anlamlı fark olduğu görüldü (p=0,001). Grup I'deki hastaların ortalama serum ürik asit düzeyi diğer gruplara göre yüksekti (p<0.05).

Sonuç: Hipertansiyon ile acil servise başvuran hastalardan hipertansif acil durumu olanlarda serum ürik asit seviyesi yüksek olabilir.

Anahtar Kelimeler: Acil servis, Hipertansiyon, Ürik asit

Abstract

Objective: There is not enough information in the literature conducted about the importance of serum uric acid levels in patients with hypertensive emergency. Our study aimed to investigate serum uric acid levels in patients admitted to the emergency department due to high blood pressure.

Materials and methods: Hypertensive emergency patients which defined as acute target organ damage with systolic/diastolic blood pressure 180/110 mmHg and above (group I), hypertensive urgency patients defined as without acute target organ damage with blood pressure of 180/110 mmHg and above (group II), and the patients with uncontrolled hypertension with systolic blood pressure between 140-180 mmHg and diastolic blood pressure between 90-110 mmHg (group III) were included in the study.

Results: One hundred twenty-four hypertensive patients (80 female, 44 male) were included. Thirty-tree patients (26.6%) were in group I, 19 (15.3%) in group II and 72 (58.1%) in group III. When compared in terms of serum uric acid level, it was found that there was a statistically significant difference between the groups (p=0.001). The average serum uric acid level of patients in group I was higher compared to other groups (p<0.05).

Conclusion: Serum uric acid levels may be elevated in hypertensive emergencies among patients admitted to the emergency department with hypertension.

Keywords: Emergency service, Hypertension, Uric acid

Yazışma adresi: Canan AKMAN, Çanakkale Onsekiz Mart Üniversitesi, Tıp Fakültesi, Acil Tıp AD, Çanakkale, Türkiye

Telefon: +90 286 263 59 50, **Mail:** drcananakman@gmail.com

ORCID No (Sırasıyla): 0000-0002-3427-5649, 0000-0002-3448-0490

Geliş Tarihi: 26.01.2021

Kabul Tarihi: 25.02.2021

DOI: 10.17517/ksutfd.868934

INTRODUCTION

True hypertensive emergencies are rare. Hypertensive emergency and urgency conditions cause a significant increase in morbidity and mortality in patients with hypertension. Hypertensive emergency is defined as a life-threatening sign of target organ damage with an acute increase in blood pressure (>180/110 mmHg). In such cases, it is aimed to hospitalize patients and reduce their blood pressure in a short time with antihypertensive medications which administered parenteral way. The most common hypertensive emergencies are ischemic cerebrovascular event, acute pulmonary edema, hypertensive encephalopathy, acute myocardial infarction, congestive heart failure and eclampsi. In hypertensive urgency, there is no evidence of acute target organ damage despite the acute increase in blood pressure (>180/110mmHg). Under these circumstances, hospitalization is not required. It is aimed to reduce blood pressure within hours or days through the treatment with oral antihypertensive drugs (1,2).

Uric acid is the end product of purine metabolism, and there is a strong relationship between serum uric acid level and blood pressure. Increased serum uric acid level may contribute to the development of hypertension through vascular dysfunction and lead to progression of target organ damage (3). Epidemiological and experimental studies show that there is a close relationship between hyperuricemia and hypertension. In addition, large prospective studies show that serum uric acid levels independently predict the development of hypertension (4). Although the treatment is successful with antihypertensive drugs, it is observed in some patients with hypertension and hyperuricemia that uncontrolled high blood pressure still continues (5). Our study aims to investigate serum uric acid levels in patients admitted to the emergency department due to high blood pressure.

MATERIALS AND METHODS

Study Design

Our study was planned retrospectively. Hypertensive patients who applied to the emergency department were included in the study. The patients were divided into three groups: Patients with hypertensive emergency whose blood pressure greate than 180/110 mmHg with with acute target organ damage (group I), patients with hypertensive urgency whose blood pressure greater than 180/110 without acute target organ damage (group II), and the patients with uncontrolled hypertension with systolic blood pressure between 140-180 mmHg and diastolic blood pressure between 90-110 mmHg (group III). We started the study after the approval of the local ethics committee Clinical Research Ethics Committee date of the decision: 01.07.2020, number: 2020-09). The World Medical Association Declaration of Helsinki was complied with by investigators. Information about patients was obtained using our hospital's record database.

Inclusion and Exclusion Criteria

Hypertensive patients (>140/90 mmHg) admitted to the emergency department and aged between 18-80 were included in the study. The patients under 18 or over 80 years of ages, with pregnancy, trauma, chronic renal failure, and whose dialysis treatment history and clinical files were missing were not included in the study.

Laboratory Analysis

Serum creatinine, urea and uric acid measured of the patients were conducted in the biochemistry laboratory using the Roche Cobas 6000 device and e501 module using the colorimetric method. Blood pressure was measured by the physician using the classical auscultatory method after each patient remained in a sitting position for at least five minutes. Care was taken to ensure that the arm was at heart level and the palm was open. It was measured twice at two-minute intervals and the mean blood pressure (systolic and diastolic) was recorded. An automatic sphygmomanometer was used for blood pressure measurement (Philips IntelliVue MX550, Netherlands).

Statistics

The data were analysed using SPSS 19.0 program. The demographic data of the patients were analysed with descriptive statistics (mean, standard deviation, percentage, frequency, etc.). The distribution of patients in terms of gender in three different hypertensive groups was analysed using chi-square analysis. The mean age of the patient groups were compared using Kruskal Wallis Test (as age data were not normally distributed). Serum uric acid, urea and creatinine values of the groups were compared using Kruskal-Wallis Test (as these values were not normally distributed). Spearman Brown correlation test was used for the biochemistry values (uric acid, urea and creatinine) of all patients and $p<0.05$ was accepted for statistical significance.

RESULTS

One hundred and twenty four hypertensive patients (80 female, 44 male) were included in the study. Thirty three patients (26.6%) were in group I, 19 (15.3%) in group II and 72 (58.1%) in group III. The mean age of the patients was 65.5 ± 13.47. There was no significant difference between the groups in terms of age and gender ($p>0.05$). The distribution of hypertensive groups by gender is shown in **(Table 1)**.

When the groups were compared in terms of serum uric acid level. a statistically significant difference was found ($p=0.001$). The mean serum uric acid level of the patients in group I was higher compared to the patients in group II and group III ($p<0.05$). There was no significant difference between group II and III in terms of serum uric acid levels ($p>0.05$).

When these groups were compared in terms of serum urea level. a statistically significant difference was found ($p=0.001$). Serum urea levels of the patients in group I were higher compared to the patients both in group II and group III ($p<0.05$). There was no significant difference between group II and III in terms of serum urea levels ($p>0.05$).

When the groups were compared in terms of serum creatinine levels. a statistically significant difference was found

Table 1. The distribution of hypertensive groups by gender

			Patient Groups			Total	p
			Hypertensive Emergency	Hypertensive Urgency	Uncontrolled Hypertension		
Gender	Female	f	20	14	46	80	0.628
		Gender %	25.0%	17.5%	57.5%	100.0%	
		Patient Group %	60.6%	73.7%	63.9%	64.5%	
		Total %	16.1%	11.3%	37.1%	64.5%	
	Male	f	13	5	26	44	
		Gender %	29.5%	11.4%	59.1%	100.0%	
		Patient Group %	39.4%	26.3%	36.1%	35.5%	
		Total %	10.5%	4.0%	21.0%	35.5%	

P: Chi-square test

Table 2. The comparison of the average age. serum urea. uric acid and creatinine levels of the hypertensive groups

Variable	Patient Group	N	Mean (Standard Deviation)	Median (Min-Max)	p	Significant Difference
Age (year)	1. Hypertensive Emergency	33	70.12 (9.29)	71 (42-87)	0.081	
	2. Hypertensive Urgency	19	66.26 (14.69)	73 (38-96)		
	3. Uncontrolled Hypertension	72	63.18 (14.32)	64 (22-85)		
Uric acid (mg/dL)	1. Hypertensive Emergency	33	7.59 (2.92)	7.2 (2.8-17.1)	0.001	I>III I>II
	2. Hypertensive Urgency	19	5.48 (1.68)	5.6 (2.4-8.2)		
	3. Uncontrolled Hypertension	72	5.39 (1.84)	5.3 (0.1-9.4)		
Urea (mg/dL)	1. Hypertensive Emergency	33	78.85 (49.58)	55.1 (21.3-232)	0.001	I>III I>II
	2. Hypertensive Urgency	19	41.76 (27.78)	38.3 (10.1-130)		
	3. Uncontrolled Hypertension	72	41.31 (22.22)	35.5 (10-119.7)		
Creatinine (mg/dL)	1. Hypertensive Emergency	33	1.69 (0.92)	1.55 (0.53-3.91)	0.001	I>III
	2. Hypertensive Urgency	19	1.21 (0.62)	1.03 (0.45-2.73)		
	3. Uncontrolled Hypertension	72	1.01 (0.44)	0.92 (0.41-2.94)		

P: Kruskal Wallis Test

(p=0.001). Serum creatinine levels were found to be higher in the patients in group I compared to the patients group III (p <0.05). When group I-II and group II-III were compared in terms of serum creatinine levels. no statistically significant difference was found (p>0.05). The comparison of the mean age. serum urea. uric acid and creatinine levels of the patient groups is given in **(Table 2)**.

DISCUSSION

A mild increase in serum uric acid level may result in renin-angiotensin-aldosterone system (RAS) activation at intracellular and extracellular levels. Increased oxidative stress, mitochondrial dysfunction, epithelial-mesenchymal transition, endothelial dysfunction and renal (arteriosclerosis, glomerular hypertension, interstitial nephritis, acute renal failure) and non-renal (metabolic syndrome, non-alcoholic fatty liver disease, hypertension, diabetes) phenotype (6). In our study serum uric acid levels of the patients in group I were found to be higher than both the patients group II and group III. However there was no statistically significant difference in terms of serum uric acid increase between group II and group III. One of the most important target organ of hypertension is renal damage (chronic kidney disease). Hyperuricemia seen in hypertensive patients may further increase the reabsorption of uric acid from the tubules by decreasing renal blood flow. In addition hypertension causes regional ischemia, decreasing both secretion and synthesis of uric acid from proximal tubules (7). Many epidemiological studies have revealed that hyperuricemia increases the risk of hypertension and chronic renal failure. It has been proven that hyperuricemia plays a pathological role in the development of hypertension and chronic renal failure through renal inf-

lammation, endothelial dysfunction and RAS activation (8).

In our study, serum urea and creatinine levels of the patients in group I were found to be higher than the values of the patients group III. Groups I and II were similar in terms of serum creatinine. Serum urea levels of the patients in group I were higher than those of both group II and group III. There was no difference between serum urea levels of the patients in group II and group III. This may be due to prerenal azotemia developing in the patients of group I. Many patients who develop acute systolic heart failure also have hypertensive emergency and urgency (9). Acute worsening in congestive heart failure is one of the target organ damage of hypertensive emergency (2). Increased serum uric acid level of the patients in group I may be a result of prerenal azotemia. Fractional excretion of uric acid in the patients with prerenal azotemia was found to be lower than the values in other etiologies of acute renal damage (acute tubular necrosis and postrenal acute renal failure) (10). In our study, serum uric acid and urea levels of the patients in group I were higher than that of both group I and group II. The reason for the similar serum creatinine levels in groups I and II may be due to the increase in the frequency of prerenal azotemia and acute heart failure in group I patients (11).

In conclusion serum uric acid levels may be higher in hypertensive emergencies among patients admitted to the emergency department with hypertension than those with uncontrolled hypertension. Hyperuricemia may predict prerenal azotemia in patients with hypertensive emergency.

Limitations

There were some limitations in our study. We planned the study retrospectively. The number of patients remained low due to insufficient data entry due to the deficiencies in the automation system of our hospital. Electrolytes (sodium, creatinine, urea and uric acid) could not be measured in urine and serum. The underlying diseases, demographic features such as smoking, body mass index etc. and drug history (allopurinol, febuxostat and losartan) of each patient could not be examined in detail in emergency department conditions. Bedside echocardiography of the patients could not be performed.

Main points: In patients with hypertensive emergency admitted to the emergency department.

- Serum uric acid level is higher than that of the patients with hypertensive urgency and uncontrolled hypertension. Serum uric acid levels are similar in the patients with hypertensive urgency and uncontrolled hypertension.
- Serum urea level is higher than that of the patients with hypertensive urgency and uncontrolled hypertension. Serum urea levels are similar in the patients with hypertensive urgency and uncontrolled hypertension.
- Serum creatinine level was found to be higher compared to the patients with uncontrolled hypertension. and similar to hypertensive urgency patients.

Conflict of Interest and Financial Status: Our study has not been financed by an institution. In this study. there is no conflict of interest among the authors on any subject.

Ethical Approval: Ethical approval of this study was obtained from the local ethics committee Clinical Research Ethics Committee date of the decision: 01.07.2020, number: 2020-09).

Author Contributions: Study Conception and Design: CA, SB; Acquisition of Data: CA, SB; Analysis and Interpretation of Data: CA, SB; Drafting of Manuscript: CA, SB ; Critical Revision: CA, SB

CA: Canan Akman. SB: Serkan Bakirdogen

REFERENCES

1. Valleloonga F, Carbone F, Benedetto F, Airale L, Totaro S, Leone D et al. Accuracy of a Symptom-Based Approach to Identify Hypertensive Emergencies in the Emergency Department. J. Clin. Med. 2020 Jul 12;9(7):2201.
2. Muiesan ML, Salvetti M, Amadoro V, di Somma S, Perlini S, Semplicini A et al. An update on hypertensive emergencies and urgencies. J Cardiovasc Med (Hagerstown) 2015;16:372-382.
3. Wang Y, Hu J-W, Lv Y-B, Chu C, Wang K-K, Zheng W-L et al. The role of uric acid in hypertension of adolescents. Prehypertension and Salt Sensitivity of Blood Pressure Med SciMonit 2017;23:790-795.
4. Gois PHF, Souza ERM. Pharmacotherapy for hyperuricemia in hypertensive patients. Cochrane Database Syst Rev 2017;13;4(4):CD008652.
5. Cho J, Kim C, Kang DR, Park JB. Hyperuricemia and uncontrolled hypertension in treated hypertensive patients. Medicine (Baltimore) 2016;95(28):4177.
6. Johnson RJ, Nakagawa T, Jalal D, Sánchez-Lozada LG, Kang DH, Ritz E. Uric acid and chronic kidney disease: which is chasing which? Nephrol Dial Transplant 2013;28(9):2221-2228.
7. Gür M, Yılmaz R, Demirbağ R, Seyfeli E, Özdoğru İ, Altıparmak Hİ et al. Relationship between elastic properties of the aorta and uric acid levels in newly diagnosed hypertensive patients. Turk Soc Cardiol 2006;34:223-229.
8. Mallat SG, Kattar SA, Tanios BY, Jurjus A. Hyperuricemia, Hypertension and Chronic Kidney Disease: an Emerhing Associ-ation. Curr Hypertens Rep 2016;18(10):74.
9. Davis JW, Almubarak M, Mukherjee A, McElwee SK, Leesar MA, Chartterjee A. Ischemic Evaluation in patients Presenting with Hypertensive Emergency/Urgency and Acute Systolic Heart Failure: Is Coronary Angiography Required for all? Cardiovascular Revascularization Medicine 2019;20(6):492-495.
10. Fushimi K, Shichiri M, Marumo F. Decreased fractional excretion of urate as an indicator of prerenal azotemia. Am j Nephrol 1990;10(6):489-494.
11. Macedo E, Mehta R. Prerenal azotemia in congestive heart failure. Contributions to Nephrology 2010;164:79-87.