

# Blood Pressure Control and Associated Factors in the Elderly Hypertensive Patients: Follow-up Data from the Special Hypertensive Outpatient Clinic

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## Abstract

**Objectives:** The primary purpose of this study is to determine demographic and clinical characteristics of hypertensive patients aged  $\geq 65$  years. The secondary objective of the study is to determine blood pressure (BP) control rates and factors affecting BP control in hypertensive patients aged  $\geq 65$  years.

**Materials and Methods:** Eighty-five hypertensive patients aged  $\geq 65$  years [57 (67%) women; mean age  $70 \pm 5$  years] that were followed at our hypertension clinic between 2009 and 2015 were retrospectively investigated.

**Results:** The BP control rate was 28.2% at the first visit. After 5-year follow-up, the rate of achieving target BP

levels was 71.8% for systolic, 85.9% for diastolic and 65.8% for both systolic and diastolic BP ( $p < 0.001$ ). Logistic regression analysis revealed that high baseline systolic and diastolic BP and low education level were independent predictors of failure to achieve BP control.

**Conclusion:** The results of our study show that the BP control rates are low in geriatric hypertensive patients. On the other hand, close follow-up of these patients in specialized hypertension outpatient clinics increases treatment success and BP control rates. High baseline systolic and diastolic BP and low education level are independent predictors of failure to achieve BP control.

**Keywords:** Elderly patients, hypertension, treatment



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## Introduction

Hypertension is one of the most important risk factors for the development of cardiovascular diseases<sup>(1)</sup>. The prevalence of hypertension increases with age, and the prevalence in patients aged  $\geq 65$  years doubles the prevalence rate in ages 40-64 years<sup>(1,2)</sup>.

Although positive effects of blood pressure (BP) control on mortality and morbidity have been shown in many studies, BP control rate remains low in geriatric population. A meta-analysis of clinical trials has showed that the treatment of hypertension in older adults is as beneficial as that in younger adults<sup>(2,3)</sup>. Randomized-controlled trials have demonstrated that antihypertensive treatment in the elderly is associated with reduction in cardiovascular events<sup>(3)</sup>. In spite of improvements in the identification and treatment of hypertension, one-third to two-thirds of geriatric hypertensive patients do not achieve optimal BP values and continue to exist at risks for target organ damage<sup>(2)</sup>.

There have been very few studies conducted in Turkey regarding demographic and clinical characteristics of hypertensive patients in the geriatric population. In addition, there are very few studies in the literature which were conducted on the follow-up of these patients, evaluated follow-up results and investigated the factors affecting BP control. The primary objective of this study was to determine demographic and clinical characteristics of hypertensive patients aged  $\geq 65$  years. The secondary objective of the study was to determine BP control rates at the end of the follow-up period and factors affecting BP control.

## Materials and Methods

The study included 85 hypertensive patients aged  $\geq 65$  years who were followed-up and treated for 5 years at the special hypertensive outpatient's clinic of our university hospital between September 2009 and September 2015. The archived medical records of the study patients were retrospectively reviewed, and all data were recorded on an electronic case report form. Patients who did not have

at least one outpatient control data per year and patients with secondary hypertension were not included in the study.

Hypertension was defined as systolic BP  $\geq 140$  mmHg and/or diastolic BP  $\geq 90$  mmHg. Patients who were previously diagnosed with hypertension and/or who used antihypertensive medications were considered to have hypertension regardless of their BP levels at the first visit<sup>(3)</sup>.

Electrocardiography (ECG) and echocardiography data of the patients in the study population were evaluated. Left ventricular hypertrophy (LVH) was evaluated on an ECG using Sokolow-Lyon index. The presence of atrial fibrillation or other types of arrhythmia and conduction abnormalities or ST segment changes were defined as pathological ECG findings<sup>(3)</sup>.

In echocardiographic examination, left ventricular mass index was calculated according to the guidelines of the American Society of Echocardiography using Devereux method. Left ventricular mass index levels  $>95$  g/m<sup>2</sup> in women and  $>115$ g/m<sup>2</sup> in men were defined as LVH<sup>(4)</sup>.

History of coronary and/or peripheral artery disease, pathological ECG findings, the presence of LVH, high creatinine ( $\geq 1.3$  mg/dL in men,  $\geq 1.2$  mg/dL in women), microalbuminuria (excretion of 30-300 mg albumin per day in 24-h urine sample) or overt proteinuria (excretion of  $>300$  mg albumin per day in a 24-h urine sample), the presence of  $\geq$  grade-2 hypertensive retinopathy on fundoscopic examination, stroke and/or transient ischemic attack were defined as the indicators of target organ damage<sup>(3)</sup>.

The patients' education levels were also recorded as low education level (people who were primary school graduates or who had a lesser level of education) and high education level (people who were high school graduates or who had a higher level of education).

The Ethics Committee of Ege University approved the study (decision no and date: 18-4/26 and 03.04.2018).

## Statistical Analysis

Categorical variables were expressed as number and percent distribution and continuous variables were expressed as arithmetic mean and standard deviation. The chi-square test was used in the comparison of categorical variables in univariate analyses, the Student's t-test was used in parametric cases where continuous variables were compared with a dichotomous independent variable, and the Mann-Whitney U test was used in non-parametric cases. Paired t-test was used in dependent group comparisons. Variables that showed statistical significance ( $p < 0.05$ ) in univariate analyses were further analysed using multivariate logistic regression analysis. In all hypothesis tests, maximum type-1 error was accepted as 0.05. SPSS 15.0 statistics package programme was used in all analyses.

## Results

Baseline demographic and clinical data of the study population recorded at the first visit are presented in Table 1.

The study included 85 hypertensive patients (57 females (67%); mean age  $70 \pm 5$  years) aged  $\geq 65$  years. At the first visit, the BP control rate was 28.2%. The systolic BP was  $151 \pm 23$  mmHg and the diastolic BP was  $92 \pm 13$  mmHg. Fourteen (16.5%) patients received monotherapy whereas 61 (71.7%) patients received dual or triple combination therapy, and 10 (11.8%) patients received  $\geq 4$  antihypertensive drugs. The mean number of visits performed over a 5-year follow-up period was  $13 \pm 3$ . During these visits, change in medication and/or combination therapy was required because of inadequate antihypertensive effect in 41 patients (48.2%) and because of adverse effects in 29 patients (34.1%). Only 15 patients (17.6%) were maintained on the same antihypertensive treatment for 5 years. The most common adverse effects because of antihypertensive medication use were orthostatic hypotension (16.4%), cough (12.9%), and constipation (8.2%).

At the end of the 5-year follow-up period, the systolic BP decreased to  $131 \pm 17$  mmHg ( $p < 0.001$ ) and the diastolic BP decreased to  $77 \pm 11$  mmHg ( $p < 0.001$ ). The rates of achieving target BP level was 71.8% ( $p < 0.001$ ) for systolic BP and 85.9% ( $p < 0.001$ ) for diastolic BP. The rate of achieving the target levels in both BP levels was 65.8% (Table 2).

Patient population was divided into two groups as patients achieving BP control ( $n=56$ , 65.8%) and those who did not achieve BP control ( $n=29$ , 34.2%) at the end of 5-year follow-up period. Both groups had similar characteristics in terms of age, gender, and body mass index (BMI) levels. However, the rate of patients with low education level (people who were primary school graduates or who had a lesser level of education) was lower in patients with controlled BP than in those without BP control (23.2% vs 65.5%,  $p=0.001$ , respectively), and baseline systolic and diastolic BP values ( $145 \pm 23$  mmHg vs  $162 \pm 20$ ,  $p=0.001$  and  $89 \pm 13$  mmHg vs  $98 \pm 11$  mmHg,  $p=0.001$ , respectively) were significantly higher in patients who did not achieve BP control (Table 3).

Multivariate logistic regression model was used to determine the predictors of achieving BP control at the end of 5-year follow-up period. Age, number of visits, education level, baseline systolic and diastolic BP levels were included in this model. As a result of logistic regression analysis, it was detected that high baseline systolic BP [odds ratio (OR)=1.28, 95% confidence interval (CI)=1.004-1.53,  $p=0.02$ ], high baseline diastolic BP (OR=1.48, 95% CI=1.005-1.93,  $p=0.02$ ) and lower education level (OR=5.64, 95% CI=1.93-16.51,  $p=0.002$ ) were found to be independent predictors of failure to achieve BP control (Table 4).

## Discussion

The results of our study show that the BP control rates are low in geriatric hypertensive patients. On the other hand, close follow-up of these patients in specialized hypertension outpatient clinics increases treatment success and BP control rates.

**Table 1.** Demographic and clinical data of patients at the first visit

Variable	(n=85)
Age (years)	70±5 (65-75)
Gender (female) (n/%)	57 (67.1)
Body mass index (kg/m <sup>2</sup> )	28.7±3.7
Education level (low education level) (n/%)	32 (37.6)
Duration of hypertension (years)	13±7 (5-35)
Number of visits	13±3 (7-25)
Regular usage of antihypertensive medication (n/%)	75 (88.2)
<b>Antihypertensive therapy (n/%)</b>	
Monotherapy	14 (16.5)
2 anti-hypertensive drugs	30 (35.3)
3 anti-hypertensive drugs	31 (36.4)
≥4 anti-hypertensive drugs	10 (11.8)
<b>Hypertension stages (n/%)</b>	
Normal or pre-hypertension	24 (28.2)
Stage 1 hypertension	25 (29.4)
Stage 2 hypertension	21 (24.7)
Stage 3 hypertension	13 (15.3)
Isolated systolic hypertension	2 (2.4)
<b>Diabetes Mellitus (n/%)</b>	10 (11.8)
<b>Hyperlipidemia (n/%)</b>	44 (51.8)
<b>Smoking (n/%)</b>	21 (24.7)
<b>BMI classification (n/%)</b>	
Normal	11 (12.9)
Overweight	42 (49.4)
Class 1 obesity	24 (28.2)
Class 2 obesity	8 (9.4)
Presence of systemic hypertension in the first-degree relatives (n/%)	55 (64.7)
<b>Target organ damage (n/%)</b>	
Coronary artery disease	10 (11.8)
Pathological ECG finding	28 (32.9)
Left ventricular hypertrophy (g/m <sup>2</sup> )	27 (31.8)
High creatinine level	14 (16.4)
Microalbuminuria	20 (23.5)
Overt proteinuria	4 (4.7)
Stroke/TIA	7 (8.2)
Hypertensive retinopathy (≥ grade 2)	28 (32.9)

**Table 1.** Continued

Variable	(n=85)
<b>Number of target organ damage (n/%)</b>	
None	26 (30.6)
1 target organ damage	30 (35.3)
2 target organ damage	22 (25.9)
3 target organ damage	7 (8.2)
<i>ECG: Electrocardiography, TIA: Transient ischemic attack, SD: Standard deviation, BMI: Body mass index</i>	
<i>Data are given as mean ± SD with total range, number of patients (n) and percentages (%)</i>	

The prevalence of hypertension is increasing with ageing population in the world. Hypertension has a significant importance as a cardiovascular risk factor in the geriatric population, and control of BP decreases cardiovascular mortality and morbidity rates<sup>(3)</sup>. However, observational and epidemiological studies show that BP control rates are not at the desired levels especially in the geriatric population<sup>(2,3)</sup>.

All patients included in our study were those who had been previously diagnosed with hypertension and who were using hypertensive medications. Although 88% of the patients stated at the first visit that they regularly used their hypertensive medication, BP control rates were quite low at the same visit. In the Patent study, which was performed to determine the prevalence of hypertension in Turkey, it was detected that 59% of hypertensive people were not aware of their high BP, only 31% of people that developed awareness were receiving treatment, BP control rate was 20% in those receiving treatment, and BP control rate was only 8.1% in the whole patient group<sup>(5)</sup>. In other studies conducted in Turkey, BP control rates among hypertensive people who were receiving medical therapy were reported to be ranging between 36% and 38%<sup>(6,7)</sup>. In the studies conducted on geriatric population group, this rate varies between 14% and 36%<sup>(6,8-10)</sup>. BP control rates in our study were 28.2% (24 of 85 patients) for systolic BP and 31.8% (27 of 85 patients) for diastolic BP, which are similar to that in other observational studies<sup>(6-8)</sup>.

There was a significant decrease in systolic and diastolic BP levels of the whole patient group at the end

of the 5-year follow-up period. Systolic BP control rate increased to 71% from 28% and diastolic BP control rate increased to 85% from 31%. The fact that the BP control rates recorded at the first visit is low despite the high rate of patients using combination therapies and number of patients who stated they used medications regularly shows that treatment success is not at the desired level. The results of our study show that diagnosing hypertension and prescribing antihypertensive treatment is not sufficient to control BP. Close monitoring of patients who start treatment, frequent BP checks, self-monitoring and dose titration of the antihypertensive medication and/or choice of combination therapies according to the measured BP levels are of high importance.

The results of our study show that there is evidence of at least one or more target organ damage in a significant portion (69.4%, 59 of 85 patients) of geriatric hypertensive patients. In a study of 1163 patients with resistant hypertension aged  $\geq 80$  years, Liang et al.<sup>(11)</sup> reported a

prevalence rate of 75% for hypertensive retinopathy and a rate of 71% for LVH. On the other hand, in a study

**Table 2.** Comparison of baseline and 5-year follow-up data

	Baseline	5 <sup>th</sup> year	p
Body mass index (kg/m <sup>2</sup> )	28.7±3.7	28.9±3.6	0.17
Average systolic blood pressure (mmHg)	151±23	131±17	<0.001
Average diastolic blood pressure (mmHg)	92±13	77±11	<0.001
Systolic blood pressure (<140 mmHg) (n/%)	24 (28.2)	61 (71.8)	<0.001
Diastolic blood pressure (<90 mmHg) (n/%)	27 (31.8)	73 (85.9)	<0.001
Heart rate (bpm)	79±8	82±12	0.12
Total cholesterol (mg/dL)	230±39	202±34	<0.001
Triglyceride (mg/dL)	147±61	145±65	0.66
HDL-cholesterol (mg/dL)	52±13	51±11	0.28
LDL-cholesterol (mg/dL)	144±31	124±28	<0.001
Fasting blood sugar (mg/dL)	106±20	105±19	0.61
Creatinine (mg/dL)	1.04±0.2	1.01±0.2	0.25
Potassium (mmol/L)	4.3±0.4	4.5±0.4	0.02
Sodium (mmol/L)	141±3	140±2	0.16
Hematocrit (%)	45±4	44±4	0.54

HDL: High-density lipoprotein, LDL: Low-density lipoprotein, SD: Standard deviation

Data are given as mean ± SD, number of patients (n) and percentages (%). p value <0.05 was considered statistically significant

**Table 3.** Comparison of demographic and clinical characteristics of patients with and without controlled blood pressure at the end of 5-year follow-up period

	Patients with controlled blood pressure (n=56)	Patients without controlled blood pressure (n=29)	p
Age (years)	70±5	70±6	0.90
Gender (female) (n/%)	35 (62.5)	22 (75.9)	0.31
Body mass index (kg/m <sup>2</sup> )	28.5±3.4	29.7±3.8	0.16
Low education level (n/%)	13 (23.2)	19 (65.5)	0.001
Duration of hypertension (years)	12±6	15±9	0.10
Number of visits	13±2	15±5	0.01
Diabetes Mellitus (n/%)	7 (12.5)	3 (10.3)	0.77
Hyperlipidemia (n/%)	29 (51.8)	15 (51.7)	0.99
Smoking (n/%)	18 (32.1)	3 (10.3)	0.05
Presence of systemic hypertension in the first-degree relatives (n/%)	36 (64.3)	19 (65.5)	0.91
Baseline systolic blood pressure (mmHg)	145±23	162±20	0.001
Baseline diastolic blood pressure (mmHg)	89±13	98±11	0.001
Baseline heart rate (bpm)	79±7	78±9	0.50
Total cholesterol (mg/dL)	201±32	204±39	0.73
Triglyceride (mg/dL)	150±74	135±42	0.33
HDL-cholesterol (mg/dL)	51±11	51±12	0.88
LDL-cholesterol (mg/dL)	121±30	129±26	0.25
Fasting blood sugar (mg/dL)	102±15	110±25	0.09
Creatinine (mg/dL)	1.04±0.3	0.95±0.2	0.03
Presence of target organ damage (n/%)	36 (64.3)	23 (79.3)	0.23
Pathological ECG finding (n/%)	6 (10.7)	8 (27.6)	0.06
Left ventricular mass index (g/m <sup>2</sup> )	94±16	110±34	0.07
Hypertensive retinopathy [ $\geq$ grade 2] (n/%)	19 (33.9)	9 (31)	0.78

ECG: Electrocardiography, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, SD: Standard deviation

Data are given as mean ± SD, number of patients (n) and percentages (%). p value <0.05 was considered statistically significant

conducted by Muxfeldt et al.<sup>(12)</sup> on outpatients admitted to a university hospital, the prevalence of LVH was reported to be 33% and the prevalence of hypertensive retinopathy was reported to be 22%. Similarly, in our study, the most frequently encountered target organ damage indicators were  $\geq$  grade 2 hypertensive retinopathy (32.9%) and LVH (31.8%). In the Patent study, high serum creatinine was detected in 2.7% of the patients, microalbuminuria was detected in 27.4% of the patients, and overt proteinuria was detected in 3.7% of the patients<sup>(5)</sup>. In our study, the prevalence of microalbuminuria was 23.5% and the prevalence of overt proteinuria was 4.7%. On the other hand, the rate of patients with high creatinine levels in our study was 16.4%, and this was higher than that reported in the Patent study. The reason for this may be that the patient population in our study was older and the number of patients with high creatinine may be higher related to this.

In the studies evaluating the factors affecting BP control in geriatric population, it was detected that Diabetes Mellitus (DM), high BMI and obesity, advanced age, family history of hypertension and active smoking were related to failure to achieve BP control<sup>(8,11)</sup>. On the other hand, in a study conducted by Lima et al.<sup>(13)</sup> on geriatric patients, there was no relationship between BP control and DM or BMI, whereas it was seen that high baseline BP level in the outpatient clinics and during 24-h BP monitoring was negatively correlated with BP control. In our study, there was no difference between the groups in terms of age, gender, BMI, DM and hyperlipidemia

frequency. In our study, systolic and diastolic BP levels measured at the first visit were significantly higher in patients who did not achieve BP control and they required more frequent outpatient control visits than patients that achieved BP control. In another study conducted by Erem et al.<sup>(14)</sup>, an inverse relationship was detected between low education level and the prevalence of hypertension. According to the results of their study, the prevalence of hypertension was as high as 74% in people with a low education level, whereas this rate was 26% in university graduates. In a study conducted by Yang et al.<sup>(8)</sup>, the rate of patients that achieved BP control was 49% in patients with a high education level and this rate was 33% in people with a low education level. In a multi-center study involving 17014 geriatric hypertensive patients, an inverse relationship was found between low education level and BP control<sup>(15)</sup>. In our study, similarly, a direct relationship was found between low education level and failure to achieve BP control. In multivariate logistic regression analysis, it has been detected that low education level and high baseline systolic and diastolic BP are independent predictors of failure to achieve BP control.

### Study Limitations

The present study has some important limitations. Study population was formed by a limited number of patients and the study was conducted in a single center. BP measurements of the patients were obtained during the outpatient examination. Ambulatory BP measurement was not performed in all patients. Thus, white-coat hypertension or masked hypertension could not be diagnosed. Because the study data were collected retrospectively, lifestyle and lifestyle changes of the patients (physical exercise, sedentary life, nutritional habits, salt and alcohol consumption, stress) could not be evaluated.

### Conclusion

The results of our study revealed demographic and clinical characteristics of hypertensive patients aged  $\geq 65$  years. In addition, BP control rates and the factors affecting BP control were evaluated at the end of 5-year

**Table 4.** Independent predictors of failure to achieve blood pressure control: logistic regression model

Variable	Odds ratio	95% Confidence interval	p
Age	0.98	0.90-1.08	0.80
Number of visits	1.13	0.98-1.30	0.07
Low educational level	5.64	1.93-16.51	0.002
Baseline systolic blood pressure	1.28	1.004-1.53	0.02
Baseline diastolic blood pressure	1.48	1.005-1.93	0.02

*p value <0.05 was considered statistically significant*

follow-up period at a specialized hypertension outpatient clinics. It can be seen that diagnosing geriatric patients with hypertension and starting antihypertensive treatment is not sufficient to achieve BP control. BP control is not achieved in a significant portion of patients despite the use of antihypertensive medications. However, close monitoring of these patients in specialized hypertension outpatient clinics increases the treatment success and BP control rates. High baseline systolic and diastolic BP and low education level are independent predictors of failure to achieve BP control.

### Ethics

**Ethics Committee Approval:** The Ethics Committee of Ege University approved the study (Decision no and date: 18-4/26 and 03.04.2018).

**Informed Consent:** Informed consent was obtained from the patients.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: U.K., F.Ö.Ç., Concept: U.K., F.Ö.Ç., Design: U.K., F.Ö.Ç., Data Collection or Processing: U.K., F.Ö.Ç., Analysis or Interpretation: U.K., F.Ö.Ç., Literature Search: U.K., F.Ö.Ç., Writing: U.K., F.Ö.Ç.

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