

The Current Status of Blood Pressure Control among Patients with Hypertension: A Survey of Actual Clinical Practice

Nobuo Hatori, Kazuyoshi Sato, Masaaki Miyakawa,
Kazuhiko Mitani, Masayuki Miyajima, Shouhei Yuasa,
Takamoto Furuki, Ikuro Matsuba and Keiichi Naka

The Kanagawa Physicians Association

Abstract

We performed a cross-sectional survey to investigate actual clinical practices regarding blood-pressure control in patients with hypertension. From October 16 to 31, 2008, postal questionnaires regarding the care of patients with hypertension were sent to members of the Kanagawa Physicians Association in Kanagawa, Japan. Data of 675 patients (mean age: 70.1 ± 10.6 years, 301 men and 374 women) were returned. The overall mean systolic blood pressure (BP) in these patients was 134.6 ± 10.6 mm Hg, and diastolic BP was 76.2 ± 8.3 mm Hg. According to the 2009 guidelines of the Japanese Society of Hypertension for the management of patients with hypertension, the target office BP was achieved by 53.9% of all subjects; 29.7% of patients with diabetes mellitus, chronic kidney disease, or a history of myocardial infarction; 72.0% of elderly patients; 23.6% of nonelderly patients (younger than 65 years); and 75.4% of patients with cerebrovascular disease. Cross-sectional analysis showed that factors significantly associated with an increased likelihood of achieving the target office BP were: 1) usage of a larger number of antihypertensive agents in nonelderly patients and in patients with diabetes mellitus, chronic kidney disease, or a history of myocardial infarction and; 2) usage of a smaller number of antihypertensive agents in elderly patients and patients with cerebrovascular disease. Further follow-up surveys are necessary to provide a full assessment. (J Nippon Med Sch 2012; 79: 69–78)

Key words: blood pressure, physicians, guidelines

Introduction

Hypertension is a common risk factor for stroke and heart disease^{1,2}. Over the past several decades, numerous studies and trials have been performed to prevent hypertension and to clarify the factors associated with blood pressure (BP) levels^{3–8}. On the basis of these research results, several hypertension management guidelines have been established for the treatment of patients with hypertension^{9–11}. The

Japanese Society of Hypertension (JSH) first published guidelines for the management of hypertension in 2000 (JSH 2000), and revisions followed in 2004¹² and 2009¹³. The major revision points in JSH 2009 were the inclusion of home BP monitoring (HBPM) goals and the categorization of patients with a history of myocardial infarction (MI) into the high-risk group of diabetes mellitus (DM) and chronic kidney disease (CKD). The prognostic value of HBPM for mortality and morbidity is superior to that of office BP^{14,15}. HBPM is one way for

Correspondence to Nobuo Hatori, MD, Kobayashi Hospital, 1-14-18 Sakaecho, Odawara, Kanagawa 250-0011, Japan
E-mail: hatnobu@pa2.so-net.ne.jp
Journal Website (<http://www.nms.ac.jp/jnms/>)

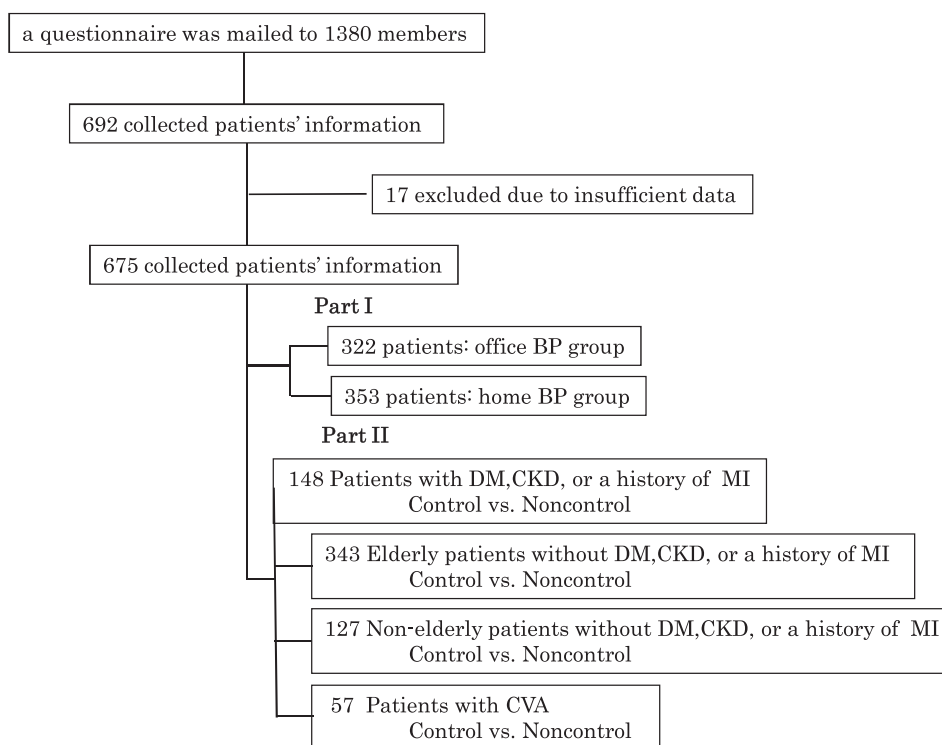


Fig. 1 Patient registration and flow chart

BP: blood pressure, DM: diabetes mellitus, CKD: chronic kidney disease, MI: myocardial infarction, CVD: cerebrovascular disease

patients to become more actively involved in their care. Some studies indicate that BP control is better when HBPM is implemented in patient^{16,17}. Despite the enormous burden of hypertension, it has not been effectively controlled. Thus, the aim of this study was to investigate the factors involved in achieving BP control (following the JSH 2009 guidelines) and to assess the efficacy of HBPM in the treatment of patients with hypertension in a actual practice.

Patients and Methods

Data and Subjects

The present study was performed in Kanagawa prefecture, Japan, from October 16 to 31, 2008. Kanagawa prefecture is located in the southwest part of the Kanto region of Japan, and has a population of approximately 9 million. A questionnaire was mailed to 1,380 members of the Kanagawa Physicians Association. The study questionnaire contained questions on the following: patient' age, sex, body mass index (BMI), duration of

hypertension treatment, concomitant disorders (DM, dyslipidemia, angina pectoris, history MI, atrial fibrillation, heart failure, stroke, CKD, hyperuricemia, peripheral arterial occlusive disease), alcohol consumption, current smoking habits, office systolic and diastolic BPs, HBPM, and types of hypertensive agents and their dosages. To avoid selection bias, patients were selected as follows: if the patient's identification number or telephone number matched the final number of the patient' consultation date, he or she was enrolled in the study. All antihypertensive drugs were adjusted to a standard dose that was in accordance with Japanese clinical practice to enable analysis of the doses. For example, the standard dose of valsartan is 80 mg, which was counted as 1.0 point¹⁸.

Data Analyses

Part I

We divided patients into 2 groups: the office BP group, in whom BPs were measured only at the physician's office and the home BP group, in whom BPs were measured both in the office and at home.

Hypertension Control in Kanagawa Actual Practice Survey

Table 1 Comparisons between home BP and office BP groups

	Office BP group		Home BP group		Statistics
	Number	322	353		
Age (years)		70.4 ± 10.7		69.8 ± 10.4	ns
Sex (male/female)		160/162 (49.7%/50.3%)		141/212 (39.9%/60.1%)	p=0.013
Duration of hypertension treatment (years)		10.4 ± 8.5		9.2 ± 8.7	ns
Body mass index (kg/m ²)		24.5 ± 4.0		23.8 ± 3.3	p=0.017
Current smoker (No.)					ns
No	254	(78.9%)	285	(80.2%)	
Unknown	17	(5.3%)	22	(6.2%)	
Yes	51	(15.8%)	46	(13.0%)	
Duration of smoking (years)		33.2 ± 15.2		33.6 ± 14.8	ns
Current drinker (No.)					p=0.044
No	215	(66.8%)	249	(70.5%)	
Unknown	17	(5.3%)	30	(8.5%)	
Yes	90	(28.0%)	74	(21.0%)	
Office BP					
Systolic BP (mmHg)		133.6 ± 8.7		135.6 ± 12.0	p=0.015
Diastolic BP (mmHg)		76.5 ± 7.4		76.0 ± 9.0	ns
Pulse rate (/min.)		69.4 ± 8.9		69.9 ± 9.9	ns
Home BP (morning)					
Systolic BP (mmHg)				130.0 ± 10.8	
Diastolic BP (mmHg)				75.5 ± 8.4	
Pulse rate (/min.)				66.2 ± 8.6	
Home BP (night)					
Systolic BP (mmHg)				125.3 ± 11.0	
Diastolic BP (mmHg)				71.6 ± 8.1	
Pulse rate (/min.)				67.6 ± 8.7	
Total number of antihypertensive agents		1.66 ± 0.76 (1-4)		2.01 ± 1.04 (1-8)	p<0.0001
Score (adjusted to standard dose)		1.60 ± 1.00		1.95 ± 1.35	p<0.0001

Abbreviations: BP, blood pressure

Comparisons between these groups were performed using the data obtained in this study.

Part II

We divided patients into 4 groups according to JSH 2009: 1) patients with DM, CKD, a history of MI, or CVD; 2) patients with CVD; 3) elderly patients 65 years and older without DM, CKD, a history of MI, or CVD; and 4) nonelderly patients younger than 65 years without DM, CKD, a history of MI, or CVD. Within these groups, the control of office BP was assessed according to JSH 2009, and patients were divided into 2 groups: those in whom BP was controlled and those in whom it was not. Thereafter, the factors that differed between the groups were analyzed.

Statistical analysis

All data were entered into a computer and

analyzed with the software program PASW Statistics 18.0 (SPSS Inc., Chicago, IL., USA). Means and standard deviations were calculated for continuous variables and proportions were calculated for categorical variables. The Student's *t*-test was used for continuous variables and the chi-square test was used for bivariate comparisons between categorical variables with a 5% (*p*<0.05) level of significance.

Results

Data of 692 patients' from 105 clinic offices were collected for the study. Seventeen patients were excluded owing to insufficient patient characteristics and office BP data. Thus, the study population consisted of 675 patients (301 men and 374 women)

(Fig. 1). The mean age of these patients was 70.1 ± 10.6 years, and the age range was 29 to 95 years.

Part I Analysis (Office BP Group vs. Home BP Group)

Comparisons between office and home BP groups

Intergroup comparisons of patient characteristics, BPs and antihypertensive agents are presented in **Table 1**. The percentage of man in the office BP group was 49.7% and higher than that in the home BP group (39.9%). Accordingly, the BMI (24.5 ± 4.0 kg/m² vs. 23.8 ± 3.3 kg/m²) and the percentage of current drinkers (28.0% vs. 21.0%) were greater in the office BP group than in the home BP group. Office systolic BP was significantly higher in the home BP group than in the office BP group (135.6 ± 12.0 mm Hg) than in the office BP group (133.6 ± 8.7 mm Hg; $p=0.015$). The average number of antihypertensive agents was greater in the home BP group (2.01 ± 1.04 ; range, 1 to 8) than in the office BP group (1.66 ± 0.76 ; range, 1 to 4). When doses for all drugs were adjusted to a standard dose (which was counted as 1.0 point), in accordance with Japanese clinical practice, the score was also higher in the home BP group (1.95 ± 1.35) than in the office BP group (1.60 ± 1.00).

Achievement rate of target office BP according to JSH guidelines 2009

The rates of control of office BP according to the JSH 2009 guidelines in each of the 4 categories are presented in **Table 2**. There were no significant differences between the groups in each of the 4 categories. The office BP was controlled in 176 of 322 (54.6%) patients in the office BP group and in 188 of 353 (53.2%) patients in the home BP group. Thus, the overall achievement rate of target office BP was 53.9%.

Part II Analysis

Characteristics of patients in whom BP was controlled or uncontrolled

Among patients with CVD, the number of current drinkers was significantly higher (44.0%) in the BP control group than in the BP noncontrol group (0%) (**Table 3**). Other patient characteristics did not differ between the BP control and BP noncontrol groups in the other 3 categories.

Comparisons of BPs in the 4 categories

All office BPs were significantly higher in the noncontrol groups except for office diastolic BP in patients with CVD (**Table 4**).

Antihypertensive agents in the 4 categories

The total number of antihypertensive agents used for the treatment of hypertension in patients with DM, CKD, and a history of MI and in nonelderly patients were significantly greater in the BP control group than in the BP noncontrol group (**Table 5**). In contrast, more antihypertensive agents were used to treat hypertension in the noncontrol groups of elderly patients and patients with CVD, and the scores adjusted to standard dosage were also higher in both noncontrol groups. In patients with DM, CKD, and a history of MI, rates of use of diuretics (31.8% vs. 12.5%), beta-blockers (29.5% vs. 14.4%) and alpha-blockers (20.4% vs. 6.7%) were greater in the control group than in the noncontrol group. Among elderly patients diuretics were used more frequently in the control group (23.3%) than in the noncontrol group (7.2%), but calcium channel blockers were used more often in the noncontrol group (79.1%) than in the control group (67.2%).

Discussion

The JSH Guidelines for the Management of Hypertension¹⁹ emphasize the importance of home BP measurement in clinical practice, because it increases compliance with hypertension treatment and helps patients evaluate the effects of the antihypertensive treatment they are receiving.

Thus, we analyzed the effects of HBPM on treatment in patients with hypertension by comparing an only office BP measurement group and an office BP and home BP measurement group. Patients in the home BP group had more severe hypertension than did those in the office BP group because the mean systolic BP was higher in the home BP group. However, the overall rates of BP control were similar in both groups. Patients in the home BP group were treated more aggressively, as shown by the greater number and higher dosages of prescribed antihypertensive agents in the office BP group. The difference in patient characteristics, especially sex, is expected to affect the results of the intergroup. The ratio of women to men was greater

Table 2 Achievement ratio of target office BP according to JSH 2009 guidelines

Category	Office BP group				Home BP group				Overall			
	322		353		322		353		675			
	No.	%	Systolic BP	Diastolic BP	No.	%	Systolic BP	Diastolic BP	Statistics	No.	Systolic BP	Diastolic BP
Patients with DM, CKD, or history of MI	75	(23.2)	133.3±9.7	75.2±7.6	73	(20.6)	134.9±12.1	74.1±9.5		148	134.1±11.0	74.7±8.5
Achievement ratio (SBP <130 mm Hg and DBP <80 mm Hg)			21 (28.0%)	58 (77.3%)			26 (35.6%)	54 (73.9%)			47 (31.7%)	112 (75.6%)
			20 (26.0%)				24 (32.8%)		ns		44 (29.7%)	
Elderly patients (SBP <140 mm Hg and DBP <90 mm Hg)	164	(50.9)	134.1±8.3	75.4±6.3	179	(50.7)	135.6±12.3	74.5±8.6		343	134.9±10.5	74.9±7.6
Achievement ratio			125 (76.2%)	163 (99.3%)			125 (69.8%)	172 (96.0%)			250 (72.8%)	335 (97.6%)
			123 (75.0%)				124 (69.2%)		ns		247 (72.0%)	
Nonelderly patients (SBP <130 mm Hg and DBP <85 mm Hg)	56	(17.3)	133.4±8.2	82.9±7.0	71	(20.1)	135.9±11.9	81.8±7.9		127	134.8±10.4	82.3±7.5
Achievement ratio			14 (25.0%)	34 (60.7%)			24 (33.8%)	46 (64.7%)			38 (29.9%)	80 (62.9%)
			10 (17.8%)				20 (28.1%)		ns		30 (23.6%)	
Patients with CVD	27	(8.3)	131.6±9.0	74.0±7.2	30	(8.4)	136.4±11.0	75.9±7.1		57	134.1±10.3	75.0±7.1
Achievement ratio (SBP <140 mm Hg and DBP <90 mm Hg)			23 (85.1%)	26 (96.2%)			20 (66.6%)	29 (96.6%)			43 (75.4%)	55 (96.4%)
			23 (85.1%)				20 (66.6%)		ns		43 (75.4%)	
Control ratio (overall)			176 (54.6%)				188 (53.2%)		ns		364 (53.9%)	

Abbreviations: JSH, the Japanese Society of Hypertension guidelines for the management of hypertension 2009; BP, blood pressure; DM, diabetes mellitus; CKD, chronic kidney disease; MI, myocardial infarction; Elderly patients, 65 years and older without DM, CKD, history of MI, or CVD; Nonelderly patients, younger than 65 years without DM, CKD, history of MI, or CVD; CVD, cerebrovascular disease.

Table 3 Characteristics of patients with controlled or uncontrolled BP

	Patients with DM, CKD, or history of MI			Elderly patients	
	Control	Noncontrol	Statistics	Control	Noncontrol
	44	104		247	96
Number					
Age (years)	69.5 ± 9.6	70.0 ± 10.2	ns	74.4 ± 5.8	75.5 ± 6.5
Sex (male/female)	20/24 (45.4%/54.5%)	54/50 (51.9%/48.0%)	ns	94/153 (38.0%/61.9%)	41/55 (42.7%/57.2%)
Duration of hypertension treatment (years)	10.4 ± 12.9	10.8 ± 7.2	ns	9.9 ± 7.7	10.6 ± 9.8
Body mass index (kg/m ²)	24.4 ± 3.9	25.1 ± 3.3	ns	23.6 ± 3.3	23.3 ± 3.7
Current smoker (No.)			ns		
No	26	285		215	80
Unknown	4	22		12	8
Yes	14	46		20	8
Current drinker			ns		
No	27	74		185	65
Unknown	4	9		14	11
Yes	13	21		48	20
		Patients with CVD			
		Noncontrol		Control	Noncontrol
		97		43	14
Number			Statistics		Statistics
Age (years)	57.0 ± 7.2	54.9 ± 8.1	ns	74.2 ± 8.9	78.7 ± 8.0
Gender (male/female)	14/16 (46.6%/53.3%)	46/51 (47.4%/52.5%)	ns	26/17 (60.4%/39.5%)	6/8 (42.8%/57.1%)
Duration of hypertension treatment (years)	7.0 ± 6.2	6.2 ± 5.9	ns	15.4 ± 11.8	9.1 ± 6.2
Body mass index (kg/m ²)	24.3 ± 3.5	24.7 ± 4.1	ns	24.6 ± 4.5	23.7 ± 4.3
Current smoking (No.)			ns		
No	22	74		33	13
Unknown	3	5		0	0
Yes	5	18		10	1
Current drinker			ns		
No	15	61		24	13
Unknown	3	5		0	1
Yes	12	31		19	0
		p=0.003			

Abbreviations: JSH, the Japanese Society of Hypertension guidelines for the management of hypertension 2009; BP, blood pressure; DM, diabetes mellitus; CKD, chronic kidney disease; MI, myocardial infarction; Elderly patients, 65 years and older without DM, CKD, history of MI, or CVD; Nonelderly patients, younger than 65 years without DM, CKD, history of MI, or CVD; CVD, cerebrovascular disease.

Table 4 Comparisons of BPs

	Patients with DM, CKD, or history of MI			Elderly patients		
	Controlled BP	Uncontrolled BP	Statistics	Controlled BP	Uncontrolled BP	Statistics
Number	44	104		247	96	
Office BP						
Systolic BP (mmHg)	122.3 ± 4.5	139.1 ± 8.9	<i>p</i> <0.0001	130.2 ± 6.9	147.0 ± 8.6	<i>p</i> <0.0001
Diastolic BP (mmHg)	69.9 ± 6.1	76.7 ± 8.6	<i>p</i> <0.0001	73.6 ± 6.8	78.5 ± 8.4	<i>p</i> <0.0001
Pulse rate (/min)	69.9 ± 12.0	71.8 ± 11.1	ns	68.5 ± 8.2	69.8 ± 10.0	ns
	Nonelderly patients			Patients with CVD		
	Controlled BP	Uncontrolled BP	Statistics	Controlled BP	Uncontrolled BP	Statistics
Number	30	97		43	14	
Office BP						
Systolic BP (mmHg)	122.9 ± 5.2	138.4 ± 8.8	<i>p</i> <0.0001	129.7 ± 7.0	147.6 ± 6.2	<i>p</i> <0.0001
Diastolic BP (mmHg)	76.9 ± 5.3	83.9 ± 7.3	<i>p</i> <0.0001	74.0 ± 6.5	78.0 ± 8.2	ns
Pulse rate (/min)	68.7 ± 8.7	70.7 ± 8.8	ns	68.6 ± 8.0	70.5 ± 12.8	ns

Abbreviations: JSH, the Japanese Society of Hypertension guidelines for the management of hypertension 2009; BP, blood pressure; DM, diabetes mellitus; CKD, chronic kidney disease; MI, myocardial infarction; Elderly patients, 65 years and older without DM, CKD, history of MI, or CVD; Nonelderly patients, younger than 65 years without DM, CKD, history of MI, or CVD; CVD, cerebrovascular disease.

in the home BP group. Thus, BMI and the percentage of current drinkers were smaller in the home BP group than in the office BP group. It should be emphasized that this study was a cross-sectional survey and an evaluation of the current status of the management of hypertensive patients. There may be a reason why HBPM was implemented in actual practice, for example, such as a poor office BP control.

This survey was performed in October 2008, just before the JSH 2009 guidelines were published. Analyzing the data obtained from this survey according to each of the categories of the JSH 2009, may appear odd. However, the difference between the JSH 2004 guidelines and the JSH 2009 guidelines is minor and involves only the classification of patients with a history of MI. There were 8 such patients in the present study, and, their inclusion did not affect the results of the statistical analysis. Although BP was better controlled in elderly patients and patients with CVD than in nonelderly patients or in high-risk patients, the mean systolic BPs did not differ among the 4 groups and remained around 134 mmHg (**Table 2**). Of course, this difference in the BP control rate resulted from differences in the systolic BP criteria. Diastolic BP decreases with age in the elderly because of the

progression of general arteriosclerosis. Thus, the mean diastolic BP was higher in nonelderly patients than in the other groups (greater than 80 mm Hg; **Table 2**). The mean age of nonelderly patients was less than 60 years, but those of the other groups were greater than 65 years (**Table 3**). Although mean systolic and diastolic BPs were less than 140/90 mm Hg, the total rate of achievement of target office BPs according to in each of the 4 categories of the JSH 2009 guidelines was only 53.9%, especially among patients with DM, a history of MI, and CKD, and those younger than 65 years without diseases were relatively poor rates in Kanagawa prefecture. There were no factors related to patients' characteristics that differed significantly between the BP control and BP noncontrol groups. We do not know whether current alcohol consumption was a factor in controlling BP among patients with CVD for light drinkers, who consumed less than an equivalent of 180 mL of Japanese sake per day, for example (data not shown). One factor among patients with DM, CKD, and a history of MI, and nonelderly patients (less than 65 years) was the aggressive use of antihypertensive agents, especially diuretics. In the Hypertension Optimal Treatment study, most patients needed to take 2 or more antihypertensive agents to lower their office

Table 5 Antihypertensive agents

	Patients with DM, CKD, or history of MI				Elderly patients				
	Controlled BP	Uncontrolled BP	Statistics	Controlled BP	Uncontrolled BP	Statistics	Controlled BP	Uncontrolled BP	Statistics
	44	104		247	96				
	2.43 ± 1.33	1.92 ± 1.06	p=0.002	1.67 ± 0.81	1.90 ± 0.98	p=0.002			p=0.025
	2.49 ± 1.85	1.97 ± 1.30	ns (p=0.057)	1.52 ± 0.99	1.83 ± 1.25	ns			p=0.017
Total number of antihypertensive drugs	32	81		166	76				p=0.035
Score (adjusted to standard dose)	1.21 ± 0.73	1.15 ± 0.51	ns	1.08 ± 0.49	1.07 ± 0.51	ns			ns
Class of drugs (including combination therapy)	33	77		148	64				ns
Ca channel blockers	5	7		13	6				p=0.007
Angiotensin II receptor blockers	14	13		36	16				ns
Angiotensin converting enzyme inhibitors	13	15		31	15				ns
Score (adjusted to standard dose)	0.9 ± 0.22	1.21 ± 0.56	p=0.009	1.07 ± 0.44	1.08 ± 0.49	ns			ns
Diuretics	9	7		16	6				ns
Score (adjusted to standard dose)	1.03 ± 0.57	0.86 ± 0.26	ns	0.68 ± 0.41	0.64 ± 0.30	ns			ns
Beta-blockers	0	1		3	0				ns
Score (adjusted to standard dose)	0.75 ± 0.33	0.79 ± 0.29	p=0.04	0.68 ± 0.44	0.67 ± 0.27	ns			ns
Alpha-blockers	0	1		3	0				ns
Score (adjusted to standard dose)	0.68 ± 0.58	0.64 ± 0.34	p=0.02	0.41 ± 0.38	0.50 ± 0.31	ns			ns
Other antiadrenergic agents	0	1		1	0				ns
Score (adjusted to standard dose)	1	1		0.97 ± 0.91	0				ns
Other vasodilators	0.6	1		1	0				ns
Score (adjusted to standard dose)				0.33	0				ns
	Nonelderly patients				Patients with CVD				
	30	97		43	14				
	2.10 ± 0.95	1.60 ± 0.65	p=0.002	2.04 ± 0.78	2.57 ± 0.64	p=0.002			p=0.028
	1.92 ± 1.40	1.62 ± 1.01	ns	1.96 ± 0.99	2.64 ± 1.13	ns			p=0.038
Total number of antihypertensive drugs	20	55		34	13				ns
Score (adjusted to standard dose)	1.07 ± 0.59	1.10 ± 0.44	ns	1.08 ± 0.48	1.11 ± 0.58	ns			ns
Class of drugs (including combination therapy)	22	68		33	12				ns
Ca channel blockers	2	7		4	2				ns
Angiotensin II receptor blockers	7	7		6	5				ns
Angiotensin converting enzyme inhibitors	8	18		8	3				ns
Score (adjusted to standard dose)	0.81 ± 0.25	0.72 ± 0.39	p=0.021	0.93 ± 0.17	1.0 ± 0.0	ns			ns
Diuretics	4	1		3	1				ns
Score (adjusted to standard dose)	0.31 ± 0.12	0.75	ns	0.52 ± 0.41	0.5	ns			ns
Beta-blockers	0	0		0	0				ns
Alpha-blockers	0	0		0	0				ns
Other antiadrenergic agents	0	0		0	0				ns
Score (adjusted to standard dose)	0	0		0	0				ns
Other vasodilators	0	0		0	0				ns
Score (adjusted to standard dose)				0	0				ns

Abbreviations: JSH, the Japanese Society of Hypertension guidelines for the management of hypertension 2009; BP, blood pressure; DM, diabetes mellitus; CKD, chronic kidney disease; MI, myocardial infarction; Elderly patients, 65 years and older without DM, CKD, post MI, or CVD; Nonelderly patients, younger than 65 years without DM, CKD, history of MI, or CVD; CVD, cerebrovascular disease.

diastolic BP to 80 mm Hg or less²⁰. In other studies^{21,22}, a large number of patients required 3 or more antihypertensive agents to achieve the specified BP targets. Although other factors, such as inadequate patient compliance, high drug costs, adverse effects of drugs, and the presence of resistant hypertension²³⁻²⁵, may cause poor BP control, the present results suggest that more aggressive antihypertensive treatment is necessary for adequate BP control in patients with DM, CKD, and a history of MI and in nonelderly patients (younger than 65 years). This differs, however, for patients with CVD and for elderly patients without these conditions. The aggressive use of antihypertensive agents was a risk factor for the failure of BP control. This has been found by other studies²⁶, and a study of treatment with multiple antihypertensive agents has demonstrated that resistance to treatment persists among elderly patients without DM or CKD despite physician adherence to treatment guidelines²⁷.

The stroke mortality rate in Japan decreased from 1961 to 1990. This decrease coincided closely with a decrease in the BP of the Japanese population¹³. A recent study in Fukushima prefecture, Japan²⁸, has revealed that target BP level according to JSH 2009, were achieved in 37.2% of patients with DM, CKD, a history of MI; 68.2% of elderly patients with these conditions; 31.7% of nonelderly patients without these conditions; and 71.4% of patients with CVD. These results were similar to those of the present study and indicated low rates of achieving treatment goals, especially in patients with DM, CKD, or a history of MI and in nonelderly patients without these conditions. The Fukushima Research of Hypertension study²⁸ emphasized the need to improve physicians' awareness of the management of hypertension according to treatment guidelines and the importance of a healthy lifestyle in maintaining good BP levels. Both our study and the Fukushima Research of Hypertension study were performed in a single prefecture in Japan, and the numbers of participating physicians were limited. However, the similar results suggest that action must be taken to improve the treatment of hypertension to prevent cardiovascular complications.

Our study had several limitations. First, there was

a selection bias for the home BP group. Patients who measured BP at home were not randomly assigned but were chosen by the physicians participating in the study. Second, this was a cross-sectional analysis, and further follow-up survey data are thus necessary for a full assessment.

Acknowledgement: We wish to thank Drs. Abe, S. Aoyagi, E. Fukuda, K. Goto, K. Gyoutoku, Y. Hara, M. Hashimoto, T. Ikeda, T. Ito, Y. Ito, T. Ishinaga, K. Kametani, K. Kato, T. Kawafune, Kawasaki, S. Kidokoro, K. Kimura, T. Maenami, H. Mori, Musha, K. Mochimaru, M. Miura, K. Minamizawa, T.C. Miyagawa, Mitsukawa, M. Nagao, S. Nakayama, Y. Nomura, H. Nishikawa, Y. Numata, M. Obana, Y. Ono, T. Sasamura, T. Sakurada, N. Sasai, K. Sato, H. Shionoiri, S. Shirai, K. Sekimoto, T. Sugawara, K. Suzuki, A. Tanabe, H. Tanabe, I. Takahashi, H. Takeo, H. Takeda, Takagishi, S. Takamizawa, Takahashi, Takagishi, K. Usui, M. Wakakura, H. Watanabe, K. Yamamoto, T. Yamamoto, Yasuda, T. Yasuda, N. Yokoyama, S. Yokoyama and K. Yoshizawa.

References

1. Antikainen R, Jousilahti P, Tuomilehto J: Systolic blood pressure, isolated systolic hypertension and risk of coronary heart disease, strokes, cardiovascular disease and all-cause mortality in the middle-aged population. *J Hypertens* 1998; 16: 577-583.
2. Lida M, Ueda K, Okayama A, et al.: Impact of elevated blood pressure on mortality from all causes, cardiovascular diseases, heart disease and stroke among Japanese: 14 year follow-up of randomly selected population from Japanese—Nippon data 80. *J Hum Hypertens* 2003; 17: 851-857.
3. Kikuya M, Hozawa A, Ohokubo T, et al.: Prognostic significance of blood pressure and heart rate variabilities: the Ohasama study. *Hypertension* 2000; 36: 901-906.
4. Lewington S, Clarke R, Qizilbash N, Peto R, Collins R: Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet* 2002; 360: 1903-1913.
5. Mechanic D, McAlpine DD, Rosenthal M: Are patients' office visits with physicians getting shorter? *N Engl J Med* 2001; 344: 198-204.
6. Pocock SJ, McCormack V, Gueyffier F, Boutitie F, Fagard RH, Boissel JP: A score for predicting risk of death from cardiovascular disease in adults with raised blood pressure, based on individual patient data from randomised controlled trials. *BMJ* 2001; 323: 75-81.
7. Stamler J, Stamler R, Neaton JD: Blood pressure, systolic and diastolic, and cardiovascular risks. US population data. *Arch Intern Med* 1993; 153: 598-615.

8. Zanchetti A, Hansson L, Clement D, et al: Benefits and risks of more intensive blood pressure lowering in hypertensive patients of the HOT study with different risk profiles: does a J-shaped curve exist in smokers? *J Hypertens* 2003; 21: 797–804.
9. Chobanian AV, Bakris GL, Black HR, et al: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 2003; 289: 2560–2572.
10. Mancia G, De Backer G, Dominiczak A, et al: 2007 Guidelines for the Management of Arterial Hypertension: The Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). *J Hypertens* 2007; 25: 1105–1187.
11. Whitworth JA: 2003 World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension. *J Hypertens* 2003; 21: 1983–1992.
12. Japanese Society of Hypertension: Japanese Society of Hypertension guidelines for the management of hypertension (JSH 2004). *Hypertens Res* 2006; 29 Suppl: S1–105.
13. Ogihara T, Kikuchi K, Matsuoka H, et al: The Japanese Society of Hypertension Guidelines for the Management of Hypertension (JSH 2009). *Hypertens Res* 2009; 32: 3–107.
14. Bobrie G, Chatellier G, Genes N, et al: Cardiovascular prognosis of “masked hypertension” detected by blood pressure self-measurement in elderly treated hypertensive patients. *JAMA* 2004; 291: 1342–1349.
15. Ohkubo T, Asayama K, Kikuya M, et al: How many times should blood pressure be measured at home for better prediction of stroke risk? Ten-year follow-up results from the Ohasama study. *J Hypertens* 2004; 22: 1099–1104.
16. Cappuccio FP, Kerry SM, Forbes L, Donald A: Blood pressure control by home monitoring: meta-analysis of randomised trials. *BMJ* 2004; 329: 145.
17. Fahey T, Schroeder K, Ebrahim S: Interventions used to improve control of blood pressure in patients with hypertension. *Cochrane Database Syst Rev* 2005; 25: CD005182.
18. Mochizuki S, Dahlöf B, Shimizu M, et al: Valsartan in a Japanese population with hypertension and other cardiovascular disease (Jikei Heart Study): a randomised, open-label, blinded endpoint morbidity-mortality study. *Lancet* 2007; 369: 1431–1439.
19. Japanese Society of Hypertension Guidelines Subcommittee for the Management of Hypertension: Guidelines for the management of hypertension for general practitioners. *Hypertens res* 2001; 24: 613–634.
20. Hansson L, Zanchetti A, Carruthers SG, et al: Effects of intensive blood-pressure lowering and low-dose aspirin in patients with hypertension: principal results of the Hypertension Optimal Treatment (HOT) randomised trial. HOT Study Group. *Lancet* 1998; 351: 1755–1762.
21. UK Prospective Diabetes Study Group: Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. *BMJ* 1998; 317: 703–713.
22. Berlowitz DR, Ash AS, Hickey EC, Glickman M, Friedman R, Kader B: Hypertension management in patients with diabetes: the need for more aggressive therapy. *Diabetes Care* 2003; 26: 355–359.
23. Ekpo EB, Shah IU, Fernando MU, White AD: Isolated systolic hypertension in the elderly: survey of practitioners’ attitude and management. *Gerontology* 1993; 39: 207–214.
24. Miller NH, Hill M, Kottke T, Ockene IS: The multilevel compliance challenge: recommendations for a call to action. A statement for healthcare professionals. *Circulation* 1997; 95: 1085–1090.
25. Pellegrini F, Belfiglio M, De Berardis G, et al: Role of organizational factors in poor blood pressure control in patients with type 2 diabetes: the QuED Study Group—quality of care and outcomes in type 2 diabetes. *Arch Intern Med* 2003; 163: 473–480.
26. Knight EL, Bohn RL, Wang PS, Glynn RJ, Mogun H, Avorn J: Predictors of uncontrolled hypertension in ambulatory patients. *Hypertension* 2001; 38: 809–814.
27. Yokokawa H, Goto A, Sanada H, Watanabe T, Yasumura S: Gaps between hypertension treatment guidelines and clinical practice in Japan: Baseline survey results from Fukushima Research of Hypertension (FRESH). *J Clin Hypertens* 2009; 11: 333–341.
28. Yokokawa H, Goto A, Sanada H, et al: Achievement Status toward Goal Blood Pressure Levels and Healthy Lifestyles among Japanese Hypertensive Patients; Cross-sectional Survey Results from Fukushima Research of Hypertension (FRESH). *Intern Med* 2011; 50: 1149–1156.

(Received, May 13, 2011)

(Accepted, October 4, 2011)