PRIMARY CARE EPIDEMIOLOGY

Control of Arterial Hypertension among Type 2 Diabetics

Ylber Jani, MD, PhD[1]*; Amet Kamberi, MD, PhD[1]; Dali Lala, MD[2]; Gafur Polisi, MD[3];
Mair Iseni, MD[^]; Arben Mirto, MD[θ]; Fatmir Ferati, MD, PhD["]; Agim Zeqiri, MD[°];
Atila Rexhepi, MD, PhD["]; Nikola Orovcanec, MD, PhD[°°]

[1]*Private Health Institute of family medicine "Herat Diagnostika", Debar;*
[2]*Private Health Institute of family medicine "Florenc", Tetovo;*
[3]*Private Health Institute of family medicine-"Polisi", Struga;*
[^]*Private Health Institute of family medicine "Poli-Medika", Gostivar;*
[θ]*Private Health Institute of family medicine "DR.Mirto, Gostivar;*
["]*Department of Internal Medicine Faculty of Medicine, Tetovo;*
[°]*General Hospital "DR Ferit Murat", Gostivar;*
[°°]*Institute of Biostatistics, Faculty of Medicine, "Ss Kiril and Metodij" University, Skopje;*
Republic of Macedonia

Abstract

Arterial hypertension (AH) frequently coexists with diabetes mellitus, occurring twice as frequently in diabetics as in the nondiabetic subjects. AH in diabetic patients is a well-recognized cardiovascular risk factor, accounting for up to 75% of additional cardiovascular disease risks, contributing significantly to the overall morbidity and mortality in this high-risk population. Patients with both disorders are prone to a markedly higher risk for premature microvascular and macrovascular complications. According to the intervention studies, the benefits that accrue after treatment is evidence based. Aggressive blood pressure (BP) control reduces both macrovascular and microvascular complications. A report of the Joint National Committee (JNC 7) on prevention, detection, evaluation and treatment of high blood pressure concluded that the blood pressure measurement in diabetic patients, should be less than 130/80 mmHg. Blood pressure is poorly controlled in most European countries and the control rate is even lower in high-risk patients, particularly in diabetic patients. Primary healthcare physicians play a very important role in treating hypertensive patients, as most of them are being followed up at the primary healthcare clinics.

The objective of this study was to determine the degree of BP control in hypertensive diabetics, according to the evidence and current guidelines, in a cohort of hypertensive diabetics, who were under general practitioner care.

Material and Methods: The study was conducted at outpatient in the health care clinics. Data was collected by 12 physicians, on 600 patients with type 2 diabetes mellitus (T2DM) and AH, seen in the clinics, during the period of study between March 2012 and March 2013. Patient demographic, clinical, and laboratory characteristics and drug usage were obtained. Patients were classified under four groups based on the degree of systolic and diastolic blood pressure control.

Results: A total of 600 patients (45.6% females and 54.3% males; mean age: 62±5.8 years) were included in the study. The mean duration of the diabetes was 5.2±2.0 years. Poor control of AH was observed among 71.4% of the cases. Only 28.6% of the diabetic patients were found to have controlled blood pressure, and the difference was found to be statistically significant (p<0.001). Angiotensin-converting enzyme (ACE) inhibitors were used in 55% of the subjects, while angiotensin receptor blockers (ARB) were used in 34%; beta-blockers were given in 37.6% of cases, whereas calcium channels blockers (CCB) were given to 30.3%, and diuretics were administered in 22.6% of the cases.

Conclusion: Only 28.3% of the hypertensive diabetics met the recommended BP values for diabetes. More efforts are required, addressed particularly to control the BP in diabetics. More aggressive therapy by the physicians concerned could improve blood pressure control and thus reduce the cardiovascular morbidity and mortality. As the adequate control of the BP usually warrants more than one medication, physicians should be careful when selecting hypertensive medications, because some combinations are not beneficial.

Keywords: *arterial hypertension; type 2 diabetes mellitus; blood pressure control.*

Corresponding author: *Ylber Jani, MD, PhD. Private Health Institute of family medicine "Herat Diagnostika", Debar, Republic of Macedonia. E-mail:* vera@mt.net.mk

Abbreviations

BW, body weight; **BH**, body height; **BMI**, body mass index; **BP**, blood pressure; **SBP**, systolic blood pressure; **DBP**, diastolic blood pressure; **Glyc**, glycemia; **Cre**, creatinemia; **TC**, total cholesterol; **LDL-C**, low-density lipoprotein cholesterol; **HDL-C**, high-density lipoprotein cholesterol; **TG**, triglyceride.

Introduction

AH and T2DM are both common, chronic conditions that frequently coexist. Patients with both disorders face markedly higher risks for premature microvascular and macrovascular complications. The occurrence of hypertension in diabetics substantially increases the risk for coronary heart disease, stroke, nephropathy and retinopathy [1-3]. According to intervention studies, the benefits accruing from the treatment of hypertension in diabetics, is evidence based [4]. A major determinant of risk reduction is the blood pressure level achieved. Aggressive control of BP reduces both macrovascular and microvascular complications. Recently, the European Society of Hypertension, European Society of Cardiology and Report of the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure (JNC7) concluded that the BP measurement in diabetic patients should be less than 130/80 mmHg [5-7]. However, BP is poorly controlled in most European countries and the control rate is even lower in the high-risk patient categories such as diabetic patients. However, studies show that 60-69% of the hypertensive diabetics treated in general practice, do not achieve the targets recommended. The discrepancy between the blood pressure targets recommended and the actual lower control rate and the reasons for it have been broadly debated [8-11]. Nevertheless, appropriate management of AH patients with T2DM remains controversial [12]. Therefore, treated but uncontrolled hypertension remains a major problem in preventive health care. Primary healthcare physicians, therefore, play a very important role in treating hypertension in diabetic patients, as most of them are being followed up at primary healthcare clinics. Hence, it would be worthwhile to investigate blood pressure control and the pursuit of targets recommended, in a cohort of hypertensive diabetics, who are under general practitioner care.

The objective of this study was to determine the degree of BP control in hypertensive diabetics, according to the evidence and current guidelines, in a cohort of hypertensive diabetics, who were under general practitioner care.

Material and Methods

In all 300 participants (137 women and 163 men) were prospectively tested. The study was conducted at an outpatient clinic. The participants in the study were selected from among the primary care patients, who were receiving ongoing care for diabetes mellitus and hypertension, between March 1, 2012 and March 1, 2013.

Inclusion criteria: Patients were eligible for inclusion in the study if they were between 45 and 79 years of age, were undergoing treatment for diabetes mellitus and hypertension, diagnosed by use-validated criteria [6]. We recorded information from all the healthcare encounters during one calendar year.

Exclusion criteria: These include a diagnosis of dementia senilis, secondary hypertension, serum creatinine level >2 mg/dl, and age below 45 and above 79.

Clinical and demographic characteristic
The survey obtained data on the age, gender, calculated body mass index, educational level, marital status, health habits, duration of hypertension and diabetes, as well as knowledge of the side effects of the target BP drugs, compliance and adherence to the drug treatment. All participants in the study were subjected to an external electrocardiogram (ECG with lab version 3.0). From the blood samples the values of glycemia, lipid status (total cholesterol, LDL-C, HDL-C, triglycerides), and creatinine, in the morning, post 12-hour fasting period were determined.

BP was measured according to standard protocol. The mean systolic and diastolic blood pressures recorded during the study period, were calculated.

Patients were classified based on the degree of their systolic and diastolic blood pressure control under 4 groups [6].

Systolic BP groups
I: (<120 mmHg); II: (120-129 mmHg); III: (130-139 mmHg); IV: (>140 mmHg)**.**

Diastolic BP groups
I: (<80 mmHg); II: (80-84 mmHg); III: (85-89 mmHg); IV: (>90 mmHg).

Controlled BP was defined as SBP <130 mmHg and DBP <80 mmHg. Uncontrolled BP was defined as SBP>130 mmHg and DBP>80 mmHg. (On the other hand, blood pressure was considered to be controlled if the current reading was less than 130/80 mmHg.)

Statistical analyses: The continuous data acquired from the examinations for each group are shown as the middle value +/- for standard deviation (SD). In the series with attributive marks, the percentage of the structure is determined (percentage). The differences in the series with attributive marks are tested with the difference test (p). In the series with numerical marks descriptive statistics are employed (Mean, 95% CI, Min, Max and SD). In the series with numerical marks with no deviation from the normal distribution, the difference is tested with t-test for independent samples (t). Logistical regressive analysis is used to test the association between the categorized variables and a *p-value* of 0.05 or less is considered the indication for statistical significance. These data are shown in the Tables and graphs. Statistical processing of the data is done by using the statistical programs STATISTICA 7.1 and SPSS 19.0.

Results

A total of 600 patients (45.6% females and 54.3% males; mean age: 62±5.8 years) completed the survey and provided data for a one-year medical record review. Tables (1 and 1a) present the basic demographic, clinical and laboratory characteristics of studied population.

A small percentage of the patients (28.3%) were seen to have had their BP under control based on the evidence and current guidelines, in a cohort of hypertensive diabetics, while a high percentage of patients (71.7%) continued to have uncontrolled BP, despite undergoing medical treatment. The difference was found to be statistically significant (p<0.001) (Tables 2 and 3). Based on the mean SBP during the study

year, 37.17% patients had high normal blood pressure, whereas 27.67% of the patients had stage I hypertension and 6.83% patients had stage II or higher BP. Whereas, based on the mean DBP during the study year, 25.83% of the patients had high normal blood pressure, 12.33% of the patients had stage I hypertension, and 1.67% had stage II or higher BP (Tables 3a and 3b).

Table 1.

Basic demographic, clinical and laboratory characteristics of study population

Variable	N	Mean ± SD	95% CI
Age(yr)	600	61.97 ± 5.8	61.5-62.4
BW (kg)	600	76.28 ± 11.8	75.3-77.2
BH(cm)	600	168.88 ± 6.5	168.3-169.4
BMI(kg/m)	600	27.3 ± 3.9	26.9-27.6
BP-d(yr)	600	6.3 ± 1.7	6.2-6.5
DM-d(yr)	600	5.2 ± 2.0	5.0-5.3
No	600	4.4 ± 0.6	4.3-4.4
Glic	600	6.4 ± 0.5	6.1-6.5
TC	600	5.9 ± 0.3	5.86-5.92
LDL-C.	600	3.4 ± 0.3	3.42-3.49
HDL-C.	600	1.3 ± 1.4	0.76-1.9
TG	600	1.96 ± 0.24	1.94-1.97
Serum creatinine	600	80.9 ± 7.5	80.4-81.6

Abbreviations: No- number of measures of BP during 1 year; DMd - diabetes mellitus duration.

Table 1a.

Basic demographic and clinical characteristics of study population

Variable		N	%
Gender	Females	275	45.8
	Males	325	54.2
Marital status	M	255	42.5
	UnM	49	8,1
	D	15	2.5
	W	97	16.1
Atherosclerotic disease	AP	27	4,5
	IM	24	8
	HF	118	19.6
	IC	13	2,1
Educational level	E	151	25.1
	H	164	44.0
	C	183	30.5
Knowledge of goal BP	Yes	280	46.6
	No	320	53.4
Exercise to lower BP	No	291	48.5
	Yes(2-3d/w)	180	30.0
	Yes(5d/w)	129	21.5
Heredity of BP	Yes	245	40.8
	No	355	59.2
Heredity of DM	Yes	301	50.1
	No	299	49.9
Medication Compliance	Yes	529	88.2
	No	71	11.8
Medication Adherence	Yes	540	90.0
	No	60	10.0
Side effect to medication	Yes	58	9.4
	No	542	90.3

Abbreviations: M- married; Un- unmarried; D- divorced; W- widowed; AP- history of angina pectoris;IM- history of myocardial infarction;HF- history of heart failure; IC- history of stroke; E - elementary school; H- high school; C- college.

Table 2.

SBP and DBP in the patient group

SBP	<120 mmHg	(120-129) mmHg	(130-139) mmHg	(140-159) mmHg	>160 mmHg	Total
N	55	115	223	166	41	600
%	9.17%	19.17%	37.17%	27.67%	6.83%	100%
DBP	<80 mmHg	(80-84) mmHg	(85-89) mmHg	(90-99) mmHg	>100 mmHg	Total
N	358	78	77	74	10	600
%	59.6%	13%	12.83%	12.33%	1.67%	100%

Table 3.

Degree of BP control in the patient group

	Pearson Chi-square: 11.85, df=1, p=0.000		
	Blood Pressure control		
	Controlled BP (<130/80 mmHg)	Uncontrolled BP (>130/80 mmHg)	Total
N	170	430	600
%	28.33%	71.67%	100%

Table 3a.

SBP category

Blood pressure category	N	%
Controlled	170	28.33%
High Normal	223	37.17%
Stage I hypertension	166	27.67%
Stage II hypertension or greater	41	6.83%

Table 3b.

DBP category

Blood pressure category	N	%
Controlled	358	59.6%
High Normal	155	25.83%
Stage I hypertension	74	12.33%
Stage II hypertension or greater	10	1.67%

The most frequently used agents were the ACE inhibitors, which were used by 55% of the patients, followed by ARB, which were used by 34% of the patients, while beta-blockers were used in 37.6% patients, CCB were used in 30.3% of the patients and diuretics were used in 22.6% patients (Table 4).

Table 4.

Used antihypertensive agents among hypertensive patients

Antihypertensives	N	%
ACE inhibitors	330	55%
ARB	204	34%
Beta-blockers	226	38%
CCB	182	30%
Diuretics	137	23%
Prazosin	5	8%

In the study groups, more than half of the patients (56.4%) were using antihypertensives as a dual therapy for BP control. Monotherapy was used in 31.1% of the patients, triple therapy was used in 11.9% of patients and quadruple therapy was used in 0.6% of the patients (Table 5).

Table 5.

Antihypertensives used as one or more agents among hypertensive patients

Character of therapy	Study group (n=600)	
	N	%
Monotherapy	187	31.1%
Dual therapy	339	56.4%
Triple therapy	72	11.9%
Quadruple therapy	2	0.6%

Among the patients with controlled SBP (<130mmHg), ACE inhibitors were used in 88.2% of the patients, ARB in 15.9% of the patients, beta blockers in 27.6% of the patients, CCB in 28.2% of the patients and diuretics in 9.4% of the patients (Table 6). Monotherapy was used in 48.2% of the patients, of whom 82.35% used ACE inhibitors as monotherapy. Dual therapy was used in 47.05% and triple therapy in 0.5% of patients (Table 7).

Table 6.

Used antihypertensives among patients with controlled SBP

Antihypertensives	Patients with controlled SBP (n=170)	
	N	%
ACE inhibitors	150	88.2%
ARB	27	15.8%
Beta-blockers	47	27.6%
CCB	48	28.2%
Diuretics	16	9.4%

 Table 7.

Antihypertensives used as one or more agents in patients with controlled SBP

Number of antihypertensives	Patients with controlled SBP (n=170)	
	N	%
Monotherapy	82	48.2%
Dual therapy	80	47%
Triple therapy	8	4.7%

From among the patients with controlled DBP, ACE inhibitors were used in 92.1% of the patients, whereas ARB was used in 7.5% of the patients, beta-blockers in 13.1% of the patients, CCB in 13.4% of the patients and diuretics in 4.4% of the patients (Table 8). Monotherapy was used in 31.1% of the patients, of whom 56.41% used ACE inhibitors as monotherapy. Dual therapy was used in 56.4% and triple therapy was used in 11.9% of patients (Table 8).

Table 8.

Used antihypertensives among patients with controlled DBP

Antihypertensives	Patients with controlled DBP (n=358)	
	N	%
ACE inhibitors	330	92.1%
ARB	27	7.5%
Beta-blockers	47	13.1%
CCB	48	13.4%
Diuretics	16	4.4%

Table 8a.

Antihypertensives used as one or more agents among hypertensive patients

Number of antihypertensives	Patients with controlled DBP (n=358)	
	N	%
Monotherapy	131	31.1%
Dual therapy	202	56.4%
Triple therapy	33	11.9%

Multivariate analysis was used to identify the association of blood pressure control and the demographic, clinical and laboratory characteristics.

We found the following factors to be significantly associated with poor BP control: age, gender, BMI, low literacy rates, poor adherence to and noncompliance with the prescribed treatment, lack of awareness and knowledge of appropriate target BP, low physical activity, presence of atherosclerotic disease, experience of specific side effects attributed to the antihypertensive medication and uncontrolled glycemia. All the parameters are given in the Tables 9 and 9a-9g.

Table 9.

Association of Age/BW/BMI with poor BP control

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% CI for EXP(B)	
							Lower	Upper
Step 1(a) Gender(1)	-.059	.314	.035	1	.851	.943	.510	1.744
Age	-.205	.034	36.079	1	.000	.814	.761	.871
BW	-.008	.025	.115	1	.735	.992	.945	1.041
BMI	-.351	.101	12.204	1	.000	**.704**	.578	.857
Constant	12.662	4.721	7.192	1	.007	315,441.82		

Variable(s) entered on step 1: Age; Body weight;BMI.

Table 9a.

Association of educational level with poor BP control

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% CI for EXP(B)	
							Lower	Upper
Step 1(a) High school(1)	.533	.539	.975	1	.323	1.703	.592	4.902
College(1)	3.044	.511	35.542	1	.000	20.985	7.715	57.083
Constant	-2.762	.465	35.256	1	.000	.063		

Variable(s) entered on step 1: (a) 1: High school(1); College(1)

Table 9b.

Association between knowledge of goal BP and poor BP control

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% CI for EXP(B)	
							Lower	Upper
Step 1(a) Knowl. of goal BP	.959	.292	10.768	1	.001	2.610	1.472	4.629
Constant	-1.570	.218	51.703	1	.000	.208		

Variable(s) entered on step 1: (a) knowledge of goal BP.

Table 9c.

Association of atherosclerotic disease with poor BP control

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% CI for EXP(B)	
							Lower	Upper
Step 1(a) AP(1)	.816	1.235	.436	1	.509	2.260	.201	25.439
IM (1)	1.845	.444	17.294	1	.000	6.329	2.653	15.102
HF(1)	.998	.748	1.782	1	.182	2.712	.627	11.740
Constant	-1.509	.160	89.466	1	.000	.221		

Variable(s) entered on step 1a; AP- angina pectoris; IM-myocardial infarction; HF- heart failure.

Table 9d.

Association of exercise with BP control

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% CI for EXP(B)	
Exercise to lower BP							Lower	Upper
Step 1(a) 2-3 d/w(1)	-.359	.483	.551	1	.458	.699	.271	1.801
5 d/w(1)	2.705	.368	53.930	1	.000	14.951	7.264	30.775
Constant	-1.927	.223	74.562	1	.000	.146		

Variable(s) entered on step 1a: Exercise to lower BP (2-3 days in week and 5 days in week).

Table 9e.

Association between medication compliance, adherence and poor BP control

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% CI for EXP(B)	
							Lower	Upper
Step 1(a) adherence	2.133	1.029	4.297	1	.038	8.441	1.123	63.42
compliance (1)	.936	.631	2.203	1	.138	2.549	.741	8.773
Constant	-4.155	1.173	12.55	1	.000	.016		

Variable(s) entered on step 1a: medication compliance, and adherence.

Table 9f.

Association of side effect attributed to medication with poor BP control

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% CI for EXP(B)	
							Lower	Upper
Step 1(a) Side effect (1)	-2.257	1.026	4.837	1	.028	.105	.014	.782
Constant	-1.144	.142	64.482	1	.000	.319		

Variable(s) entered on step 1a: Side effect attributed to medication.

Table 9g.

Association between Glyc / TC / TG and poor BP control

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% CI for EXP(B)	
							Lower	Upper
Step 1(a) Glycemia	-4.173	1.285	10.543	1	.001	.015	.001	.191
TC	-2.400	.949	6.394	1	.011	.091	.014	.583
TG	-11.388	2.627	18.797	1	.000	.0002	.000	.002
Constant	58.222	10.480	30.867	1	.000			

Variable(s) entered on step 1a: Glycemia, TC, TG.

Discussion

Hypertension is known to contribute to diabetic microvascular and macrovascular complications [13]. To reduce the risk, hypertension must be diagnosed accurately and promptly, and the patient should receive adequate treatment. However, new guidelines have been published to emphasize the importance of aggressive BP in diabetics [5-7]. Only 28.3% of the 600 hypertensive diabetics, in this study, met the currently recommended BP value for diabetes (<130/80mmHg) based on the evidence and current guidelines [5-7], despite ongoing medical treatment. This indicated that even greater efforts are required to control BP in diabetics. In this study, it was observed that the predominant part of the BP which was poorly controlled was the SBP (>130mmHg) which accounted for 71.4% of cases (Table 1). Results from the Systolic Hypertension in Elderly Program (SHEP) and Systolic Hypertension in Europe (Sys-Eur) trial favored the aggressive treatment of diabetics with isolated systolic hypertension [14,15]. Therefore, greater efforts are required to address this aspect of BP. Older age was associated with poorer BP control, relative to that seen in the younger treated patients. It was found that SBP increases with age, but the DBP tends to level off between 55 to 60 years. This increase in the SBP is a strong predictor of cardiovascular disease with advancing age [16]. The clinical benefits of treating systolic hypertension in older patients have now been demonstrated in several randomized, placebo-controlled trials; however, the implications of these trials may not be fully accepted in routine practice. Even the oldest patient, age >80 years, appears to benefit from antihypertensive therapy. It is possible that despite the proven benefits of antihypertensive therapy in this age group, the older patients are still treated less aggressively compared with the younger ones [17]. Increased BMI was associated with poorer BP control. The present finding is consistent with a few prior studies that have identified the correlations between poor BP control and BMI [5,6]. A minimum of 20-40 minutes of aerobic exercise performed less than five times a week was associated with poorer BP control. Studies show that exercise and weight reduction, help independently, in reducing the BP, while combining both have additive benefits in diabetic hypertensives [19,20]. The lack of knowledge of appropriate SBP and the low literacy rate were also found to be risk factors for poor BP control. Patients who indicated, during the interview, their lack of awareness that

their target SBP should be <130/80 mmHg, were significantly more likely to have a higher mean blood pressure documented in their medical records. Such patients may have been less likely to take their medication, adopt healthy lifestyle changes or see their physician if their blood pressure was outside the ideal range. Educational interventions have also been shown to improve compliance with BP medication. However, not all trials concerned with patient education resulted in improved compliance or BP control. The same authors did find some improvement in both compliance and BP control when the patients were taught to check their own BP and chart it, along with their pill-taking schedule. The important difference between these two approaches may lie in the relevance of the educational message to the patient's specific BP levels (as opposed to general concepts about hypertension and the associated risks) [8, 21]. Other factors against BP control with combined medication are noncompliance and non-adherence. The Canadian Coalition for Blood Pressure Control reported a non-compliance rate of 50%. Non-adherence is the major cause of treatment failure [22, 23]. Patients seen in the clinic may get tired of taking long-term medication for their BP and blood glucose control. The impact of co-morbidity on hypertension control has not been examined extensively in large sized studies. We found angina to be associated with better blood pressure control. This may be due to the improved compliance in these patients, more aggressive treatment or the direct effect of cardiovascular disease. A trend was also observed for patients with congestive heart failure or a history of myocardial infarction to have better blood pressure control. Although the study sample included a large number of diabetic patients, diabetes was not associated with better control despite the published recommendations suggesting that these patients, in particular, should be well controlled with a target of <130/80 mmHg [24, 25]. Another potentially important observation was the relationship between poor BP control and adverse events attributed to antihypertensive medications. Patients who report adverse effects may also differ in terms of unmeasured factors, which are also associated with uncontrolled hypertension. It was observed that most patients with uncontrolled hypertension had poorly controlled blood glucose and lipids. The results from both ACCORD and ADVANCE trials indicate that near-normal glycemic control for a median of 3.5 to 5 years does not reduce the cardiovascular events within that time frame [26, 27]. Physicians' educational input with respect to the importance of BP control in diabetics and the better selection of drugs for combination therapy should be considered promptly and efficiently.

In this study, ACE inhibitors were found to be the most frequently utilized antihypertensive agents (used by 55% of the patients), followed by ARB, which were used by 34% of the patients. Recent trials have suggested that for the prevention of cardiovascular events, ACE inhibitors may be superior to alternative antihypertensive agents [28, 29]. Results from the Heart Outcome Prevention Evaluation (HOPE) study showed that a reduction in the cardiovascular events with ACE inhibitors was much greater than that expected for SBP reduction alone, compared with the placebo

[30, 31]. The ACE inhibitors favorably affected not only the cardiovascular events, but also the renal ones as well as the quality of life when compared with other regimens [32, 33]. In this study, 31% of the patients with controlled BP used an antihypertensive as the agent in monotherapy, and 56.5% of the patients with controlled BP used an antihypertensive as the agent of dual therapy. It appears to be advisable to combine the ACE inhibitors with other medications in order to have a more potent effect. The JNC 7 favors the combination of drugs for a more potent BP reduction. However, it does not favor the combination of ACE inhibitors with B blockers or the combination diuretics with calcium channel blockers. Therefore, for patients with uncontrolled BP, it is advisable to observe the type of drugs used in combination before deciding to add on another drug to the existing regimen [6].

Study Limitations

Several limitations in this study deserve mention. As the study design was observational, each patient was managed at the discretion of his or her physician. Study design limited the ability to make causal inferences regarding the associations between the predictor variables and hypertension control.

Clinical Implications

These data provide further evidence that poor BP control is common and that patients at particular risk of poor control can be identified. Targeted interventions to improve the management in such patients could make a substantial difference in stemming the epidemic of poorly controlled hypertension. This study provides a framework for identifying hypertensive patients who are at high risk for poor control, and many of the factors identified may be amenable to improvement. Older patients can be targeted for greater attention to BP control, particularly in light of the evidence for improvement in the clinical outcomes with hypertension therapy in this population. Patients with poor knowledge of the goal of their hypertension therapy should be informed about their target BP, to enable them to participate more fully in their own management. Finally, clinicians should discuss with patients, the potential adverse effects of their hypertension therapy, look out for the presence of such symptoms in routine follow-up history taking, and when they occur, make relevant modifications to the therapy.

Conclusion

Only 28.3% of the hypertensive diabetics met the recommended BP values for diabetes. More efforts are required, addressed particularly to control the BP in diabetics. More aggressive therapy by the physicians concerned could improve blood pressure control and thus reduce the cardiovascular morbidity and mortality. As the adequate control of the BP usually warrants more than one medication, physicians should be careful when selecting hypertensive medications, because some combinations are not beneficial.

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