Blood Pressure Control in Hypertensive Patients With Left Ventricular Hypertrophy. The VIIDA Study

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Introduction and objectives. The aims were to determine the effectiveness of blood pressure (BP) control in hypertensive patients with left ventricular hypertrophy (LVH), as detected by ECG, and to identify the variables associated with poor control, particularly in diabetics.

Methods. The study included hypertensive patients with ECG evidence of LVH who attended cardiology outpatient clinics between April 2003 and November 2004. Patient characteristics and clinical variables were recorded on admission to the study.

Results. Of the 16 123 patients included, 4037 (25.04%) had LVH at presentation. Some 58.1% of these latter patients had a history of cardiovascular disease. Only 8.1% of diabetic patients had BP values below 130/80 mm Hg, whereas 22.4% of nondiabetic patients were well-controlled. Multivariate analysis showed that the only independent predictors of poor BP control were diabetes (odds ratio [OR]= 3.62, 95% confidence interval, [CI] 2.7–4.7), female sex (OR= 1.18, 95% CI, 1.02–1.33), increased voltage recording in lead V5 (OR= 1.027 per mm, 95% CI, 1.01–1.03), and body mass index (OR= 1.03, 95% CI, 1.00–1.05), whereas a history of cardiovascular disease was associated with good BP control (OR= 0.57, 95% CI, 0.48–0.70).

Conclusions. The prevalence of LVH, as identified by ECG, was high in hypertensive patients attending cardiology outpatient clinics, and comorbid conditions were common. Control of BP was suboptimal, particularly in diabetic patients, fewer than 10% of whom were well-controlled. Finally, BP control in patients with LVH was influenced by sex, body mass index, and a history of cardiovascular disease.

Key words: *Hypertension. Left ventricular hypertrophy. Blood pressure control.*

Control de las cifras de presión arterial en los pacientes hipertensos con hipertrofia ventricular: estudio VIIDA

Introducción y objetivos. Evaluar el grado de control de cifras de presión arterial (PA) en hipertensos con hipertrofia ventricular izquierda (HVI) definida por el electrocardiograma y detectar las variables que se asocian a mal control, principalmente en diabéticos.

Métodos. Desde abril de 2003 hasta noviembre de 2004 se incluyó a los hipertensos vistos en consultas de cardiología con criterios electrocardiográficos de HVI. Se determinaron las distintas variables en el momento de la inclusión.

Resultados. Se incluyó a 16.123 pacientes, de los que 4.037 ya presentaron HVI (25,04%). El 58,1% de éstos tenían antecedentes de enfermedad cardiovascular. Sólo el 8,1% de los pacientes diabéticos presentó cifras de PA sistólica y diastólica < 130 y 80 mmHg respectivamente, mientras que el 22,4% de los no diabéticos estaban controlados. En el análisis multivariable, los predictores de mal control fueron la diabetes (*odds ratio* [OR] = 3,62; intervalo, 2,7-4,7), el sexo femenino (OR = 1,18; 1,02-1,33), el voltaje aumentado de la derivación V5 (por cada milímetro, OR = 1,027; 1,01-1,03) y el índice de masa corporal (IMC) (OR = 1,03; 1,00-1,05); el antecedente de enfermedad cardiovascular se comportó como un factor asociado a buen control (OR = 0,57; 0,48-0,70).

Conclusiones. Los hipertensos atendidos en consultas de cardiología presentan una alta prevalencia de HVI detectada por el electrocardiograma y una gran comorbilidad. El control de las cifras de PA es subóptimo, en especial en pacientes diabéticos, en quienes no alcanza el 10%. Por último, el control de los valores de PA en pacientes con HVI depende, además, del sexo, el IMC y los antecedentes.

Palabras clave: *Hipertensión arterial. Hipertrofia ventricular izquierda. Control de presión arterial.*

The first and second authors made similar contributions in conducting the study and publishing the results.

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Received March 14, 2007.
Accepted for publication September 10, 2007.

ABBREVIATIONS

ACE: angiotensin-converting enzyme
ARBs: angiotensin receptor blockers
BMI: body mass index
BP: blood pressure
LVH: left ventricular hypertrophy
OR: odds ratio

INTRODUCTION

Hypertension (HT) is a vitally important risk factor for the development of cardiovascular disease and a significant public health problem. It has been reported that for every 20-mm Hg increase in systolic pressure and every 10-mm Hg increase in diastolic pressure, the risk of cardiovascular events doubles in individuals with blood pressure values between 115/75 and 185/115 mm Hg.[1] For this reason, the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC) has classified blood pressure into different categories, each of which is related to a different estimation of morbidity and mortality.[2]

Various clinical trials have shown that blood pressure (BP) control with the use of pharmacological treatment can reduce adverse events related to this factor.[3] Despite this evidence, BP control remains insufficient. In Spain, according to the CARDIOTENS study,[4] only 36% of hypertensive patients with associated heart disease presented BP values <140/90 mm Hg, and the percentage is much lower in the subgroup of patients with diabetes.[5]

One of the earliest cardiovascular alterations produced by HT is left ventricular hypertrophy (LVH), which, when detected on electrocardiography (ECG), provides valuable prognostic information (predicting cardiovascular and cerebrovascular disease)[6,7] and aids in the decision of which drug regimen is most suitable.[8] Both electrocardiography and echocardiography allow assessment of LVH regression, which implies an improvement in the prognosis.[9]

The aim of this study is to determine the degree of BP control in hypertensive patients with left ventricular hypertrophy as defined by the ECG and investigate variables associated with poor control, with a particular focus on the diabetic patients included in the study.

METHODS

The VIIDA study in a multicenter, cross-sectional study performed in outpatient cardiology units all over Spain, following approval by an independent ethics committee for clinical investigation. The study was designed in 2003 by the Hypertension Section of the Spanish Society of Cardiology (Sección de Hipertensión de la Sociedad Española de Cardiología) in conjunction with the Outpatient Cardiology Section of the Spanish Society of Cardiology (Sección de Cardiología Extrahospitalaria de la Sociedad Española de Cardiología), and 200 cardiologists from these 2 sections participated. Data collection took place between April 2003 and November 2004. Consecutive patients diagnosed with HT were included, with no limits as to age or a history of cardiovascular disease in outpatient cardiology units. Patients were invited to participate by the investigating physicians, and after receiving information on the study and signing a consent form, the study variables were collected from their medical records. When it was deemed necessary, additional examinations were performed.

The data were compiled in a questionnaire. In the first phase, consecutive hypertensive patients who came to the unit were screened. The initial questionnaire collected data on HT history, age, sex, weight, height, cardiovascular risk factors, and cardiovascular disease. All patients underwent ECG study to investigate LVH, which was defined according to the criteria of Sokolow-Lyon (sum of the R-wave in lead V_5 or V_6 and the S-wave in lead V_1 >35 mm) or the Cornell voltage criteria (sum of the R-wave in lead aVL and the S-wave in lead V_3 >20 mm in women or >28 mm in men), or both assessment systems.

In the second phase, only patients with LVH on ECG study were analyzed. Demographic data were obtained (age and sex), anthropometric data (weight [kg] and height [cm]), cardiovascular risk factors (smoking, diabetes, hypercholesterolemia), and the course or history of cardiovascular disease (myocardial infarction, angina, intermittent claudication, heart failure, and stroke). Biochemical data were analyzed (plasma concentrations of total cholesterol, low-density lipoproteins [LDL-C] and high-density lipoproteins [HDL-C], triglycerides, baseline blood glucose, uric acid, and serum creatinine). In addition, glomerular filtration was determined from the MDRD-4 formula, which includes the variables creatinine, age, sex, and race. All data were obtained prospectively, except the analytical values, for which values obtained up to 6 months before data collection were used.

Blood pressure was measured with a mercury sphygmomanometer according to standard methods. The patient was asked to rest for 5 minutes, and after that time, 3 BP measurements were taken at 2-minute intervals. The mean of the last 2 determinations was considered the patient's BP. Based on the guidelines of the European Society of Hypertension and the JNC-7, BP was considered controlled at <140/90 mm Hg, and in diabetics at <130 mm Hg systolic and <80 mm Hg diastolic pressure.

TABLE 1. **Associated Cardiovascular Disease in Patients with Hypertension and Left Ventricular Hypertrophy**

	Patients (n=3962), n (%)	95% CI
History of vascular disease	2275 (58.17)	56.4-59.5
Myocardial infarction	694 (17.74)	16.5-18.9
Angina	022 (26.13)	24.7-27.5
Stroke	349 (8.92)	8.0-9.8
Peripheral vascular disease	331 (8.46)	7.6-9.3
Heart failure	873 (22.32)	21.0-23.6
Atrial fibrillation	927 (24.32)	23.0-25.7

Statistical Analysis

Qualitative variables are presented with their frequency distribution. Quantitative variables are expressed as the mean and standard deviation (SD). Associations between qualitative variables were assessed with the χ^2 test or Fisher exact test. The Student *t* test for independent samples was used to analyze the behavior of the quantitative variables for each of the independent variables. In all cases, the distribution of the variable was confirmed against the theoretical models, testing the hypothesis of homogeneity of variances. In these tests, the null hypothesis was rejected with a type 1 error or an alpha error of <.05.

Binary logistic regression models (multivariate analysis) were built to explain the independent association between variables showing a relationship with the dependent variable (BP control) in the bivariate analysis at a significance level of *P*<.01. Variables were introduced in the model using the forward conditional method. The statistical analysis was performed with SPSS version 11.0 (Chicago, Illinois, USA).

RESULTS

Baseline Characteristics

Over the study period, 16 123 consecutive patients with HT were screened, and 4037 (25.04% of the population) presented LVH as defined by the above-described criteria. Among the patients with LVH, 3962 (98.1%) were assessable, including 47.6% women and 52.4% men, with a mean age of 68.16 years and mean BMI of 27.8. Among the total cohort, 27.3% of patients (1083) were diabetic (91.6% type 2), 56.8% had dyslipidemia, and 13.8% were smokers. The mean number of drugs used was 2.26: 55.4% of patients were receiving diuretics, 47.8% beta-blockers, 37.5% calcium channel blockers, 43.7% angiotensin-converting enzyme (ACE) inhibitors, 39.9% angiotensin receptor blockers (ARB), and 0.4% alpha-blockers.

The patients' cardiovascular diseases at the time of recruitment for the study are summarized in Table 1.

Differential Characteristics Between Diabetic and Nondiabetic Patients

Diabetic patients were older and more likely to have a history of cardiovascular diseases (infarction, angina, stroke, peripheral vascular disease, and heart failure). There were no differences with regard to LVH characteristics on ECG. The mean number of drugs used was considerably higher in the subgroup of patients with diabetes, as well as the percentage of ACE inhibitor use as treatment; use of the remaining drugs was similar to that of nondiabetic patients (Table 2).

Blood Pressure Values and Degree of Control

Only 8.1% of patients with diabetes were well controlled; that is, systolic and diastolic BP were <130 mm Hg and <80 mm Hg, respectively. Among the nondiabetic population, 22.4% were controlled (<140/90 mm Hg). Differences in the degree of control between the 2 subgroups were significant (*P*<.001). As to systolic pressure alone, 23.6% of nondiabetic patients had controlled systolic BP, whereas only 10.8% of diabetic patients were controlled (systolic BP <130 mm Hg). The degree of diastolic BP control was also greater in the nondiabetic population (52.1% with diastolic BP <90 mm Hg) versus diabetic patients (26.2% with diastolic BP <80 mm Hg).

After stratification of the population according to BP values (1 stratum per each 10 mm Hg), we observed that somewhat more than 90% of the nondiabetic population presented a diastolic BP less than one stratum above normal (ie, up to 100 mm Hg) whereas in diabetic patients the proportion was around 75% (diastolic BP up to 90 mm Hg) (Table 3). In addition, around 52% of nondiabetic patients had systolic BP up to 150 mm Hg, whereas approximately 35% of patients with diabetes had systolic BP up to 140 mm Hg (Table 4).

Epidemiological Differences Between Controlled and Noncontrolled Patients

As compared to well controlled patients, the poorly controlled group included more women (42% vs 48.9%;

TABLE 2. **Differences in Characteristics and Cardiovascular Disease Between Diabetic and Nondiabetic Patients**[a]

	Diabetic (n=1083)	Nondiabetic (n=2879)	*P*
Age, mean, years	69.8	67.6	<.001
Women, %	55.9	44.8	<.001
Smokers, %	9.6	14.8	<.001
BMI, mean (SD)	28.6 (4.2)	27.5 (3.8)	<.001
History vascular disease, %	70.7	53.5	<.001
Myocardial infarction, %	25.7	14.8	<.001
Angina, %	32.7	23.9	<.001
Stroke, %	11.1	8.1	.004
Peripheral vascular disease, %	13.2	6.7	<.001
Heart failure, %	28.7	20.1	<.001
Atrial fibrillation, %	25.5	23.4	NS
Antihypertensive drugs, mean (SD)	2.47 (1.4)	2.25 (1.3)	<.001
Diuretics, %	59.9	54.1	NS
Beta-blockers, %	47.3	48	NS
Calcium channel blockers, %	39	36.7	NS
ACE inhibitors, %	49.9	41.2	.003
ARBs, %	42.3	43.9	NS
Alpha-blockers	0.38	0.46	NS

[a]ARBs indicates angiotensin receptor blockers; SD, standard deviation; ACE inhibitors, angiotensin-converting enzyme inhibitors; BMI, body mass index.

TABLE 3. **Diastolic Blood Pressure Classified into 10-mm Hg Strata**

	Diabetic, n (%)	Nondiabetic, n (%)
Total	986	2851
Stratum, mm Hg		
≤60	62 (6.29)	118 (4.14)
61-70	135 (13.69)	347 (12.18)
71-80	276 (27.99)	708 (24.85)
81-90	271 (27.48)	877 (30.78)
91-100	189 (19.17)	638 (22.39)
101-110	43 (4.36)	133 (4.67)
111-120	6 (0.61)	20 (0.7)
>120	4 (0.41)	8 (0.28)

TABLE 4. **Systolic Blood Pressure Classified into 10-mm Hg Strata**

	Diabetic, n (%)	Nondiabetic, n (%)
Total	986	2851
Stratum (mm Hg)		
≤100	8 (0.81)	11 (0.39)
101-110	14 (1.42)	56 (1.96)
111-120	66 (6.7)	135 (4.74)
121-130	110 (11.17)	335 (11.75)
131-140	170 (17.26)	518 (18.17)
141-150	204 (20.61)	539 (18.91)
151-160	166 (16.85)	550 (19.29)
161-170	111 (11.27)	321 (11.26)
171-180	73 (7.41)	205 (7.19)
181-190	30 (3.05)	83 (2.91)
191-200	21 (2.13)	66 (2.31)
>200	13 (1.32)	32 (1.12)

P=.001), obese patients, (21.6% vs 25%; *P*=.045), and patients with diabetes mellitus (11.3% vs 28.9%; *P*<.0001). There were no differences between the subgroups with regard to age or percentage of smokers.

As to the analysis of differences in associated diseases, well controlled patients presented a higher prevalence of cardiovascular disease (64.1% vs 55.6%; *P*<.001), mainly atrial fibrillation (27.3% vs 23.6%; *P*=.04) and myocardial infarction (29.2% vs 24.6%; *P*=.03), and a lower prevalence of peripheral vascular disease (10.2% vs 13.5%; *P*=.04); there were no differences with respect to the history of angina, stroke, heart failure, creatinine values, or glomerular filtration, as estimated by the MDRD-4 formula. On electrocardiography, poorly controlled patients presented higher-voltage waves in the leads consistent with the criteria for LVH (Table 5).

With regard to treatment, both well controlled and poorly controlled patients were taking a similar number of drugs on average. There were no differences between the groups in the use of diuretics, beta-blockers, calcium channel-blockers, ARBs, or alpha-blockers, but ACE inhibitor use was higher in controlled patients (Table 5) and in the diabetic group (Table 2).

Predictors of Poor Blood Pressure Control

In the multivariate analysis, which included clinical variables of known value for BP control (age, sex, personal history of cardiovascular disease, diabetes, renal function, body mass index, electrocardiographic parameters, and treatment administered), the only independent predictors of poor control were diabetes (odds ratio [OR]=3.2; 95% confidence interval [CI], 2.7-4.7), female gender

TABLE 5. **Differential Characteristics Between Controlled and Noncontrolled Hypertensive Patients**[a]

	Controlled (n=602)	Noncontrolled (n=3360)	*P*
Age, mean (SD), years	68.1 (11.8)	68.2 (10.8)	NS
Women, %	42	48.9	.001
Ratio women:men	0.724	0.957	
BMI, mean (SD)	27.3 (4)	27.9 (3.9)	<.001
Obesity, %	21.6	25	.045
Diabetes mellitus, %	11.3	28.9	<.001
Smokers, %	13.3	13.7	NS
History of CVD, %	64.1	55.6	<.001
Atrial fibrillation, %	27.3	23.6	.04
Myocardial infarction, %	29.2	24.6	.03
Angina, %	35.1	37.5	NS
Stroke, %	12.5	13.7	NS
Peripheral vascular disease, %	10.2	13.5	.04
Heart failure, %	34.7	31.3	NS
Creatinine, mean (SD), mg/dL	1.17 (0.76)	1.14 (0.71)	NS
EGF, mean (SD), mL/min/1.73 m^2	68.05 (22.1)	67.47 (21.9)	NS
R in V_5, mean (SD), mm	18.6 (8.7)	19.9 (8.7)	.003
S in V_1, mean (SD), mm	12.8 (5.1)	13.8 (5)	.001
R in aVL, mean (SD), mm	10.5 (4.9)	11.3 (5)	.001
S in V_3, mean (SD), mm	15.3 (7.1)	15.3 (6.8)	NS
Antihypertensive drugs, mean (SD)	2.23 (0.91)	2.31 (0.92)	NS
Diuretics, %	59.9	54.1	NS
Beta-blockers, %	47.3	48	NS
Calcium channel blockers, %	39	36.7	NS
ACE inhibitors, %	49.9	41.2	.003
ARBs, %	42.3	43.9	NS
Alpha-blockers, %	0.38	0.46	NS

[a]ACE inhibitors indicates angiotensin-converting enzyme inhibitors; ARBs, angiotensin receptor blockers; BMI, body mass index; CVD, cardiovascular disease; EGF, estimated glomerular filtration (Cockcroft); SD, standard deviation.

(OR=1.18; 1.02-1.33), and increased voltage in lead V_5 of the ECG, which refers to greater LVH (OR=1.027; 1.01-1.03 per millimeter), as well as body mass index (OR=1.03; 1.00-1.05), whereas a history of established cardiovascular disease was a protective factor against poor BP control (OR=0.57; 0.48-0.70) (Figure 1).

DISCUSSION

According to the findings of the VIIDA study, hypertensive patients seen in outpatient cardiology units present a high prevalence of ECG-proven LVH together with an elevated number of cardiovascular risk factors. Other studies have reported a lower prevalence of LVH in patients with hypertension,[10,11] but the populations differed, since the patients had been recently diagnosed and were at a lower risk. Published studies in our setting show percentages similar to those reported herein, with LVH observed in 20% of patients seen in primary care centers[12] and 25.4% of patients seen in hospital units.[13] The diagnosis of LVH is important because it allows stratification of the patient's prognosis and establishment of adequate treatment, which improves the patient's risk profile and regression of the disease. There are several methods for determining LVH, but the most useful and widely available is ECG study, which, by measurement of the voltage values in several leads, provides a great deal of information that facilitates both the diagnosis and follow-up.[14]

The subgroup of hypertensive diabetic patients with LVH is particularly important because they have a poorer prognosis and their management is more complex. In the present study, this subgroup was older, the majority were women, and they had a more unfavorable cardiovascular profile (higher prevalence of cardiovascular disease, angina, stroke, etc) than patients without diabetes, and these circumstances were associated with poorer BP control, despite the fact that both subgroups received similar pharmacological treatment. These findings are in keeping with those obtained in a substudy of the LIFE (Losartan Intervention For Endpoint reduction in hypertension) study,[15] performed in 1195 patients with LVH and diabetes who presented a higher body mass index, greater cardiovascular risk according to the Framingham tables, and a higher prevalence of cardiovascular disease, with a lower percentage of smokers. In the LIFE study, patients were randomized to treatment with losartan or atenolol, and the BP values obtained were similar in the 2 treatment groups; the therapeutic end point (systolic BP <140 mm Hg) was

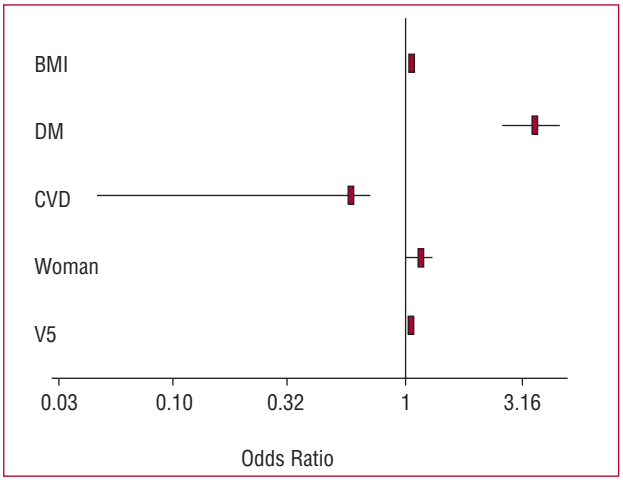

Figure 1. Predictors of poor blood pressure control. Multivariate analysis (logistic regression) adjusted for age, sex, diabetes, use of angiotensin-converting enzyme inhibitors, body mass index, voltages in V_1, V_5, and aVL, and cardiovascular disease.
BMI indicates body mass index; CVD, cardiovascular disease; DM, diabetes mellitus; V_5, voltage in lead V_5 (mm).

attained in only 40% of patients. In our sample, the results for BP control were poorer, since it is not an interventional study and the values according to current guidelines[2] are lower than those used in the LIFE substudy.

Blood pressure control in the present study was suboptimal, particularly in patients with diabetes, in whom it did not reach 9%, although the proportion of nondiabetic patients was somewhat better at 22.5%. Although these results are worrisome, they are similar to the reported findings from other recent studies in our setting. For example, in the ERIC-HTA study (an epidemiological study to assess the risk of stroke in the hypertensive Spanish population spontaneously consulting at health centers), HT was well controlled in only 25.1% of nondiabetic and 5.6% of diabetic patients.[16]

Nonetheless, a series of factors have shown that BP measurement in the outpatient setting tends to exaggerate and give a more pessimistic vision of reality. It is known that recording BP in a patient who is seated rather that lying down results in a mean increase of 5 mm Hg above the true values. In addition, if the patient's back is not supported by the back of the chair, the increase is 6 mm Hg, and if the patient's legs are crossed, the BP increase is 6-8 mm Hg. This tendency can also be explained by the fact that values are rounded up in nondigital measuring devices, by treatment-related factors (non-compliance or low doses), and by the environment in which BP is measured.

In the current study, patients were stratified by BP values to determine the percentage that come close to attaining the therapeutic objective while not actually reaching it, which might somehow reduce the magnitude of the problem. On stratification of the study population into subgroups of 10 mm Hg (Table 4) and considering BP control acceptable in patients with systolic BP and diastolic BP one stratum above normal, that is, ≤150/100 mm Hg for nondiabetic and ≤140/90 mm Hg for diabetic patients (attributable to possible error in BP measurement in the outpatient setting), we found that the percentage of well controlled patients increased considerably. This might justify the underprescription of medication in these patients, with the physician recognizing that BP measurement in the office tends to yield results somewhat higher than the true values. Nevertheless, it should remain very clear that the values taken as objectives should be those recommended in clinical practice guidelines, which have proven to reduce cardiovascular complications.

As to the determinants of good BP control, a history of cardiovascular disease (ischemic heart disease, atrial fibrillation) was particularly important in this regard,[17,18] whereas factors such as obesity, diabetes, and female gender predisposed to poor BP control. In general, the main reasons for this are the following: first, patients with a history of cardiovascular disease are better managed (in the present study, mean number of antihypertensive drugs was higher, 2.65 [1.34] vs 2.4 [1.25]; $P<.001$) and more closely monitored, probably because of greater involvement on the part of physicians, the patients themselves, and those around them; second, the degree of control in patients with diabetes is stricter and therefore harder to adhere to; and third, it has been demonstrated that treatment in women and obese persons is suboptimal. However, other recognized factors predictive of poor BP control reported in various studies (elevated creatinine levels, history of stroke, and number of antihypertensive drugs used) [19] were not identified as such in the present study. Another important finding obtained in this study is the relationship between the degree of LVH and BP control: patients with higher-voltage recordings in V_5 presented poorer BP control.

Contrary to what might be expected, poorly controlled patients took the same number or more drugs than those who were well controlled, with no significant differences regarding the classes of drugs taken. One possible explanation for this might be that the degree of control would depend, among other factors, on the stage of vascular disease: in advanced phases, BP control would be very difficult[20] because of the established injury to the vessel wall, particularly in populations who are less sensitive to their status and have shown poorer compliance (women and obese patients). Another possible reason is that in cases where adherence to therapy is poor, the cardiologist might add drugs to the patient's regimen without first making sure that the patient is complying with the former prescription.

The limitations of this study include those inherent to any observational study that does not allow randomization and limits prevalence calculations, the absence of data from hypertensive patients without LVH to perform comparisons, and the errors derived from BP measurement (due to the use of non-uniform devices, with differences

in cuff size and calibration, etc), although measurements were performed according to current recommendations as is done in other studies on HT. It should be kept in mind that the results cannot be applied to the general population, but only to those attended in the cardiology outpatient setting. The large sample of patients with a high prevalence of ECG-proven LVH and associated comorbid conditions seen in outpatient units in our area makes the results obtained worthy of note in our setting.

In conclusion, patients with HT consulting in cardiology outpatient units present a high prevalence of LVH detected by ECG study and considerable comorbidity associated with poor BP control despite combined treatment. This is particularly true for diabetic patients, whose BP control according to current guidelines is minimal.

REFERENCES

1. 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;360:1903-13.
2. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, 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;289:2560-72.
3. Collins OR, Peto R. Antihypertensive drug therapy: effects on stroke and coronary heart disease. In: Swales JD, editor. Textbook of hypertension. Oxford: Blackwell; 1994. p. 1156-64.
4. González-Juanatey JR, Ezquerra EA, Vidal JV, Caro JL, Acuna JG, Maqueda IG. Impacto de la hipertensión en las cardiopatías en España. Estudio Cardiotens 1999. Rev Esp Cardiol. 2001;54:139-49.
5. González-Juanatey JR, Alegría EE, Maria García AJ, González MI, Vicente LJ. Impacto de la diabetes en las enfermedades cardíacas en España. Estudio CARDIOTENS 1999. Med Clin (Barc). 2001;116:686-91.
6. Verdecchia P, Schillaci G, Borgioni C, Ciucci A, Gattobigio R, Zampi I, et al. Prognostic value of a new electrocardiographic method for diagnosis of left ventricular hypertrophy in essential hypertension. J Am Coll Cardiol. 1998;31:383-90.
7. Levy D, Salomon M, d'Agostino RB, Belanger AJ, Kannel WB. Prognostic implications of baseline electrocardiographic features and their serial changes in subjects with left ventricular hypertrophy. Circulation. 1994;90:1786-93.
8. Wachtell K, Rokkedal J, Bella JN, Aalto T, Dahlof B, Smith G, et al. Effect of electrocardiographic left ventricular hypertrophy on left ventricular systolic function in systemic hypertension (The LIFE Study). Losartan Intervention For Endpoint. Am J Cardiol. 2001;87:54-60.
9. Okin PM, Devereux RB, Liu JE, Oikarinen L, Jern S, Kjeldsen SE, et al. Regression of electrocardiographic left ventricular hypertrophy predicts regression of echocardiographic left ventricular mass: the LIFE study. J Hum Hypertens. 2004;18:403-9.
10. Verdecchia P, Schillaci G, Borgioni C, Ciucci A, Gattobigio R, Zampi I, et al. Prognostic significance of serial changes in left ventricular mass in essential hypertension. Circulation. 1998;97: 48-54.
11. Schillaci G, Verdecchia P, Borgioni C, Ciucci A, Guerrieri M, Zampi I, et al. Improved electrocardiographic diagnosis of left ventricular hypertrophy. Am J Cardiol. 1994;74:714-9.
12. Lozano JV, Redon J, Cea-Calvo L, Fernández-Pérez C, Navarro J, Bonet A, et al. Estimación del riesgo de un primer ictus en la población hipertensa española en atención primaria. Estudio ERIC-HTA. Med Clin (Barc). 2005;125:247-51.
13. Pascual JM, Rodilla E, Gonzalez C, Perez-Hoyos S, Redon J. Long-term impact of systolic blood pressure and glycemia on the development of microalbuminuria in essential hypertension. Hypertension. 2005;45:1125-30.
14. Okin PM, Devereux RB, Jern S, Kjeldsen SE, Julius S, Nieminen MS, et al. Regression of electrocardiographic left ventricular hypertrophy during antihypertensive treatment and the prediction of major cardiovascular events. JAMA. 2004;292:2343-9.
15. Lindholm LH, Ibsen H, Dahlof B, Devereux RB, Beevers G, De Faire U, et al. Cardiovascular morbidity and mortality in patients with diabetes in the Losartan Intervention For Endpoint reduction in hypertension study (LIFE): a randomised trial against atenolol. Lancet. 2002;359:1004-10.
16. Lozano JV, Redon J, Cea-Calvo L, Fernández-Pérez C, Navarro J, Bonet A, et al. Hipertrofia ventricular izquierda en la población hipertensa española. Estudio ERIC-HTA. Rev Esp Cardiol. 2006;59:136-42.
17. Knight EL, Bohn RL, Wang PS, Glynn RJ, Mogun H, Avorn J. Predictors of uncontrolled hypertension in ambulatory patients. Hypertension. 2001;38:809-14.
18. Andrade SE, Gurwitz JH, Field TS, Kelleher M, Majumdar SR, Reed G, et al. Hypertension management: the care gap between clinical guidelines and clinical practice. Am J Manag Care. 2004;10:481-6.
19. Greenberg JD, Tiwari A, Rajan M, Miller D, Natarajan S, Pogach L. Determinants of sustained uncontrolled blood pressure in a national cohort of persons with diabetes. Am J Hypertens. 2006;19:161-9.
20. Ruilope LM. Long-term protection in at-risk hypertensive patients — a role for nifedipine GITS? Blood Press. 2002;11:106-9.