Self Measurement of Blood Pressure for Control of Blood Pressure Levels and Adherence to Treatment

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Abstract

Background: The measurement of blood pressure (BP) by the patient himself without strict protocols, adequate training, and validated equipment at their own household is defined as self measured blood pressure (SMBP).

Objective: To evaluate the interference of the SMBP in treatment adherence and blood pressure control.

Methods: The study included 57 patients, 38 in the study group (SG) and 19 in the control group (CG). These patients were followed for 12 months and assessed at randomization (V1) as well as in the sixth (V2) and the twelfth month (V3). Compare the mean blood pressure by casual measurement, by SMBP and by ambulatory monitoring of blood pressure (AMBP), laboratory tests and the answers to the questionnaire on lifestyle. The instruments used were: OMRON HEM 714, for SMBP; OMRON 705 CP, for the casual measurement, and Monitor SPACELABS 9002 for the AMBP.

Results: The average age was 62.05 ± 10.78 in the SG and 55.42 ± 11.87 in the CG (p = 0.03). The values of systolic blood pressure (SBP) by casual measurement in the SG and CG were: 140.01 ± 16.73 mmHg and 141.79 ± 23.21 mmHg in V1 (p = 0.72), 135.49 ± 12.73 mmHg and 145.69 ± 19.31 mmHg in V2 (p = 0.02), 131.64 ± 19.28 mmHg and 134.88 ± 23.21 mmHg at V3 (p = 0.59). The values of diastolic blood pressure (DBP) were: 84.13 ± 10.71 mmHg and 86.29 ± 10.35 mmHg in V1 (p = 0.47), 81.69 ± 10.88 mmHg and 89.61 V2 ± 11.58 mmHg (p = 0.02), 80.31 ± 11.83 mmHg and 86 ± 13.38 mmHg in V3 (p = 0.12).

Conclusion: Patients in the SG had adherence to non-pharmacological treatment similar to the CG, but they had greater adherence to drug treatment and used fewer antihypertensive drugs. There was no difference between groups when comparing the metabolic profile and renal function. (Arq Bras Cardiol 2012;98(2):167-174)

Keywords: Blood pressure; blood pressure monitoring, ambulatory/instrumentation; medication adherence.

Introduction

Treatment adherence is the extent the patient's behavior coincides with the prescription of drugs and the following guidelines related to the adoption of a healthy lifestyle. Among the many factors responsible for poor adherence to treatment of hypertension (AH), the main ones are: oligosymptomatic and chronic nature of hypertension, socioeconomic and cultural factors, inadequate understanding and awareness of the problem, aspects related to the health system; relationship between health professionals and patients, and complexity of the therapeutic system[1]. To improve patient compliance, it is essential to insert him in the treatment process, informing them of the importance of knowing and achieving blood pressure goals.

The blood pressure measurement by the patient at home with validated devices and after proper training is the concept that defines the self measured blood pressure (SMBP). The SMBP is less subject to interference that commonly observed in measurements performed by health professionals in hospital settings, and has values closer to the reality of day to day[2]. The superiority of this methodology, as compared to casual measurement of blood pressure (BP), both the diagnosis and prognosis of hypertensive patients, already being demonstrated in some studies[3,4] have an impact on better BP control, due to greater adherence to treatment in reducing the inertia of the health care professional to increased[5] blood pressure levels and reduce the unnecessary use of antihypertensive drugs, due to the identification of carriers of the white coat[6] effect.

Recent studies demonstrated that self measured BP has a better correlation and comparison with the AMBP than casual measurement, and it should be considered a cheap and effective monitoring of BP in the hypertensive[7] population.

BP values obtained by self measured BP are smaller than those of the casual measurement, and this correlation remains in the range of reduction of blood pressure with pharmacological treatment. Although they are smaller, these numbers are more predictive of cardiovascular outcomes because there is elimination of the white-coat effect with the monitoring methods. On average, the values are 20%

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lower in SMBP as compared to casual[8] measurement. In addition, hypertensive patients accompanied with the SMBP have better blood pressure control compared to those followed by the casual measurement. This improvement is slight, but significant, and it can still be implemented in the use of methodologies that allow the self-adjustment of the medication by the patient, monitored remotely by health professionals[5,9]. It is interesting to notice that, even with a few measures, the SMBP has better predictive value for stroke (CVA) of the casual measurement, however, the greater the number of measures, the better the risk prediction[10].

The superiority of the methods of BP monitoring as compared to casual measurement, both for the diagnosis and prognosis of hypertension, is well regimented. These methods should, where possible, integrate the care of patients[11-14]. What remains at issue is whether the inclusion of the patient as a subject in the process of treating disease by measuring blood pressure at home having knowledge of these values, interferes, in a beneficial way in controlling blood pressure levels and adherence to treatment.

Based on this knowledge, we developed a study to examine whether the use of self measured BP for a period of 12 months it would mean better control of blood pressure and metabolism, favorable changes in lifestyle and, ultimately, increased adherence to treatment.

Methods

The protocol was approved by the Ethics in Human Research, under number 144/07, on September 26, 2007. All participants were informed about the study procedures and signed an informed consent.

This is a prospective, randomized unicentric study in 2:1 ratio. The sample consisted of 57 patients monitored for more than five years by the Arterial Hypertension League (AHL), Hospital das Clínicas, Federal University of Goiás, and it was distributed in study group (SG) and control group (CG).

Inclusion criteria were adults of both genders (age 18 and less than 70 years) with arterial hypertension under drug treatment, and at regular follow-up appointments (the criterion was regular attendance at all visits in the previous year). Exclusion criteria were: inability or refusal to sign the consent form, participation in other research protocols, patients with chronic diseases in terminal stages, patients with hypertension stage III[8] or resistant hypertension, obesity (BMI> 30 kg / m^2) , cardiac arrhythmia, history of cardiocirculatory events in the last six months (acute myocardial infarction, stroke, transient ischemic attack), chronic renal failure, decompensated heart failure, decompensated diabetes or other diseases that, according to the investigator, could compromise the study, secondary hypertension, and hormone replacement therapy that was not on stable dose for at least six months.

According to the protocol, patients were followed for 12 months, with quarterly medical visits and other examinations at randomization and every six months.

Comparing the experimental and control groups of variables, we use the data obtained at randomization, as identified by convention visit 1 (V1), at 6 months (V2) and at 12 months (V3).

The intervention protocol was proposed by the delivery of SMBP validated device, OMRON brand (HEM714), patients in the EG after training for proper use. This group was instructed to measure and record the blood pressure values in daily protocol at least twice a week (Mondays and Fridays) at random times and quiet place, without having practiced physical exercise for 60 minutes, without intake of food or alcohol and coffee or smoked up to 30 minutes previously without talking before and during the measurements. Patients were also asked to write down the values obtained after the completion of the procedure daily, which was delivered every three months during the appointments in AHL.

Blood pressure levels in both groups were evaluated by measuring casual at all visits, adopting the techniques recommended by the VI Brazilian Guidelines on Arterial Hypertension[15]. The BP was measured using a validated automatic digital sphygmomanometer (OMRON 705 CP) with the patient seated, after ten minutes of rest, and arm supported at the time of the precordium. It was measured twice with an interval of two minutes, and we considered the mean value as the value of BP at each visit.

AMBP was performed in both the SG and CG in the randomization, at 6 and 12 months follow-up. We used the Monitor Spacelabs 9002 (oscillometric method), and measures were standardized every 15 minutes during wakefulness (7h to 23h) and every 20 minutes during sleep (from 23h to 7h). However, the data were considered valid when monitoring took place over a period of 24 ± 2 hours and the percentage of successful readings was greater than 80% of the measures performed[16]. Both the AMBP and the casual measurements were considered for the comparative analysis of BP between the groups.

The anthropometric parameters were assessed as follows: (i) body mass individuals wearing light clothing and without shoes, using the brand Toledo electronic scale, accurate to 100g, (ii) height - barefoot individuals, using the Filizola stadiometer, accurate to 1mm, (iii) body mass index (BMI) - use the formula established by Quetelet (BMI = weight in kg / height^2 in meters)[17].

In all visits, we also collected data on adherence to treatment, namely the practice of regular physical activity (at least three times per week), dietary habits, smoking, alcohol consumption, regular use and number of antihypertensive ingested daily. In addition, at randomization and every six months, were conducted electrocardiogram, blood glucose, lipid profile and creatinine.

These data were stored and structured in Excel Microsoft for further analysis in the Statistical Package of Social Science (SPSS) for Windows, version 15.0. We used the Kolmogorov-Smirnov test to verify the normal distribution of variables. In the comparison between experimental and control groups, we used the Student t test for independent data on the variables that were normally distributed. With regard to data not normally distributed, we used the Mann-Whitney test. The chi-square test was used to detect differences between groups with respect to categorical variables (physical activity, healthy eating, alcohol intake and smoking habit).

Results

The mean age was 62.05 ± 10.78 years in the SG and 55.42 ± 11.87 years in the CG (p = 0.03), and mean duration of follow-up was 10.68 months ± 2.07 in the SG and 10.61 ± 2.52 in CG (p = 0.90). There was abandoning of the protocol by a patient of the SG and CG, because they did not perform the V3. Also in the CG, one patient died two months after randomization.

The variables considered in the randomization and throughout the study are described in Table 1. We performed the comparison of BP levels obtained by the casual measurement on visits 1, 2 and 3, and significant differences were found in favor of the SG for both systolic blood pressure (SBP) and for diastolic (DBP) in the sixth month. The differences disappeared by 12 months (Figure 1). In analyzing the BP through the AMBP, the results were similar in all visits (Figure 2).

Regarding metabolic parameters, blood glucose values, total cholesterol, LDL cholesterol and triglycerides were slightly higher in the CG during all visits, but without statistical significance (p> 0.05) in the comparative analysis between the groups. Blood glucose values in the SG were 96.39 ± 24.95 mg / dl in V1, 99.42 ± 32.21 mg / dl in V2 and 97.17 ± 30.18 mg / dl in the V3, while the CG were 106.43 ± 30.75 mg / dl in V1, 115.62 ± 41.83 mg / dl in V2 and 103.80 ± 15.38 mg / dl in V3. The values of total cholesterol in SG were 184.19 ± 43.55 mg / dl in V, 181.06 ± 38.56 mg / dl in V2 and 181.68 ± 38.94 mg / dl in the V3, whereas in the CG were 199.56 ± 51.27 mg / dl in V1, 191.92 ± 37.16 mg / dl in V2 and 192.55 ± 37.24 mg / dl in V3. Regarding triglycerides, the SG values were 128.37 ± 54.63 mg / dl in V, 146.79 ± 102.87 mg / dl in V2, and 138.75 ± 63.86 mg / dl in V3, as in the CG they were 173.25 ± 68.03 mg / dl in V1, 174.85 ± 66.08 mg / dl in V2, and 142.91 ± 77.68 mg / dl in V3. The creatinine values were very similar in both groups at all times: 0.89 ± 0.27 mg / dl and 0.84 ± 0.17 mg / dl in V1, 0.91 ± 0.26 mg / dl and 0 , 84 ± 0.15 mg / dl in V2, 0.90 ± 0.37 mg / dl and 0.84 ± 0.12 mg / dl in V3, for the SG and CG, respectively.

In the parameter assessment of adherence to treatment, we observed that both at randomization and at follow-up groups were similar with regard to the so-called non-medication treatment. The regular practice of physical activity in the SG and the CG was present respectively in 65.8% and 47.4% of patients in V1 (p = 0.09) and in 67.6% and 61.1% in V2 (p = 0.22), and in 67.6% and 58.8% in V3 (p = 0.19). Food intake according to dietary guidelines occurred in the SG and CG, respectively, 91.1% and 78.9% in V1 (p = 0.12), 97.4% and 88.9% in V2 (p = 0.21), and in 97.3% and 100% in V3 (p = 0.68). Smoking was observed in the SG and CG, respectively, 7.9% and 5.3% in V1 (p = 0.40) and in 5.3% and 0% in V2 (p = 0.45); and 5.3% and 0% in V3 (p = 0.31).

Regarding the analysis of pharmacological treatment, there was a significant difference in favor of the SG in the third visit, when 100% of the sample was under regular use of medication (Table 2).

Table 1 - Comparison between the SG and CG in relation to anthropometric and blood pressure at visits 1, 2 and 3

Variables	Control Group	Study Group	p
Age (years)	55.42 ± 11.87	62.05 ± 10.78	0.039
Follow-up (months)	10.61 ± 2.52	10.68 ± 2.07	0.909
BMI1 (Kg/m²)	27.07 ± 3.22	26.23 ± 3.76	0.408
BMI2 (Kg/m²)	27.09 ± 3.27	26.42 ± 4.67	0.586
BMI3 (Kg/m²)	27.16 ± 3.54	25.99 ± 3.94	0.303
SBP1 (mmHg)	141.79 ± 23.21	140.01 ± 16.73	0.742
SBP2 (mmHg)	145.69 ± 19.31	135.49 ± 12.73	0.022
SBP3 (mmHg)	134.88 ± 23.21	131.64 ± 19.28	0.592
DBP1 (mmHg)	86.29 ± 10.35	84.13 ± 10.71	0.472
DBP2 (mmHg)	89.61 ± 11.58	81.69 ± 10.88	0.020
DBP3 (mmHg)	86.00 ± 13.38	80.31 ± 11.83	0.121
SBPm1 (mmHg)	125.71 ± 14.09	128.64 ± 14.54	0.492
SBPm2 (mmHg)	125.17 ± 14.06	123.42 ± 11.24	0.672
SBPm3 (mmHg)	131.75 ± 16.92	126.29 ± 13.34	0.504
DBPm1 (mmHg)	81.76 ± 22.45	78.33 ± 9.39	0.434
DBPm2 (mmHg)	76.08 ± 5.87	74.71 ± 8.79	0.498
DBPm3 (mmHg)	80.00 ± 10.61	78.00 ± 10.86	0.749

BMI - body mass index; SBP - systolic blood pressure (casual measurement); DBP - diastolic blood pressure (casual measurement); SBPm - systolic blood pressure (AMBP alertness); DBPm - diastolic blood pressure (AMBP alertness); 1 - 1 visit 2 - visit 2, 3 - 3 visit.

Finally, we also compared the number of types of antihypertensive drugs used and we found a number of similar drugs in the V1 and V2, but different in V3 (the largest number of drugs was used in the control group, Table 3).

Discussion

The results showed that, regarding the control of BP assessed by casual measurement, that the SG reached faster treatment goals with a significant difference in the sixth month, for both SBP (p = 0.02) and for DBP (p = 0.02). These values tend to match up at 12 months, although they remain lower in the SG (Figure 1). This difference can be explained by a decrease of inertia to treatment observed among health professionals and patients, as well as in other studies with similar subjects of study[18,19]. Moreover, the difference may be due to increased adherence to drug treatment.

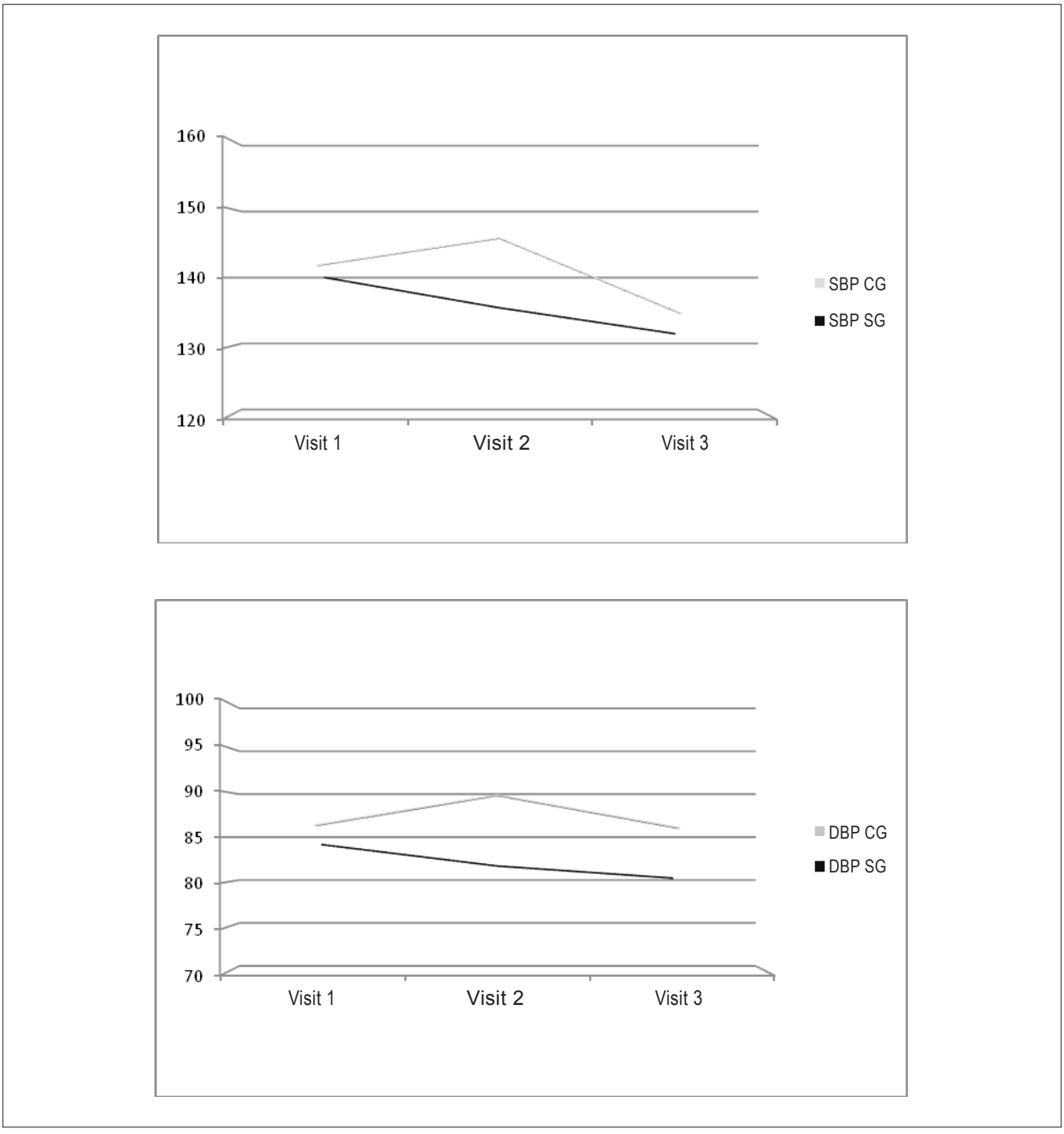

Figure 1 - *Behavior of systolic blood pressure (SBP) and diastolic (DBP) in mmHg, measured by casual measurement during V1 (p = 0.74 to 0.47 for SBP and DBP), V2 (p = 0.02 to 0.02 for SBP and DBP) and V3 (p = 0.59 to 0.12 for SBP and DBP).*

We should point out that some studies have shown even better results when allowed and directed the patient to do self- adjustment on doses of drugs, according to SMBP[5,9].

Achieving earlier blood pressure goals is one of the important aspects in the treatment of hypertension, with proven impact on reducing cardiovascular outcomes, as demonstrated in the VALUE trial, in which getting faster blood pressure control resulted in lower incidence of outcomes in that group[20].

In analyzing the behavior of BP assessed by AMBP, we found no significant differences in mean values over 24 hours for both SBP and DBP, despite the tendency to decrease in the BP

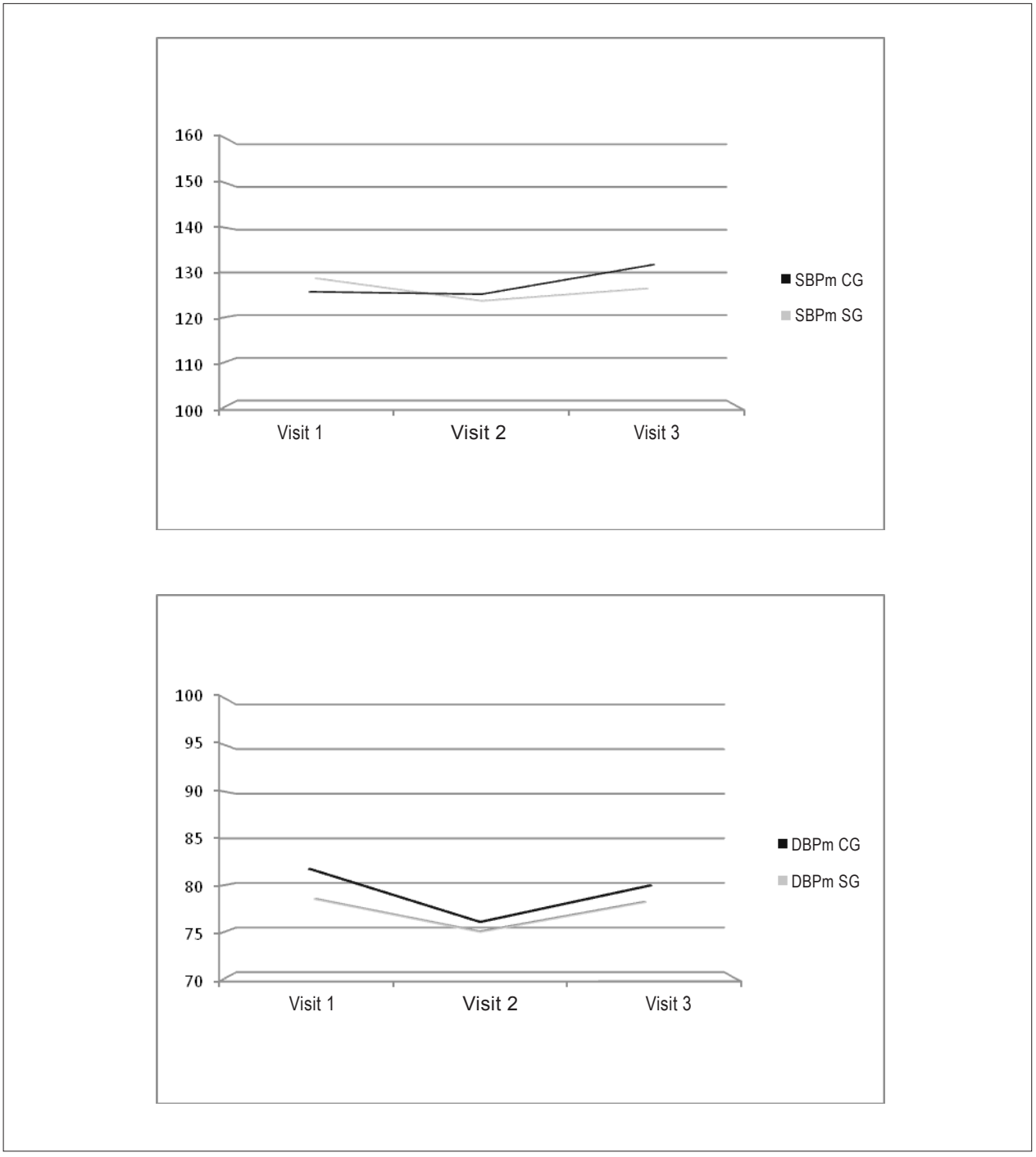

Figure 2 - *Behavior of mean systolic blood pressure on AMBP during 24 hours (SBPm) and mean diastolic (DBPm) in mmHg, measured by casual measurement during V1 (p = 0.49 to 0.43 for SBP and DBP), V2 (p = 0.67 to 0.49 for SBP and DBP and V3 (p = 0.50 to 0.74 for SBP and DBP).*

Table 2 - Variables related to adherence to pharmacological treatment

Variables	Control Group (n = 19)	Study Group (n = 38)	p
Regular Use 1			
Yes	16 / 84.2%	29 / 763%	0.223
No	3 / 15.8%	9 / 23.7%	
Regular Use 2			
Yes	15 / 83.3%	36 / 94.7%	0.150
No	3 / 16.7%	2 / 5.3%	
Regular Use 3			
Yes	15 / 88.2%	37 / 100.0%	0.031
No	2 / 118%	-/0.0%	

Regular use - regular use of antihypertensive medications; 1 - 1 visit 2 - visit 2, 3 - 3 visit.

Table 3 - Distribution of patients according to the class number of antihypertensive drugs used

Variables	Control Group	Study Group	p
Medication on V1			
1	4 / 21.1%	9 / 23.7%	
2	7 / 36.8%	15 / 39.5%	0.980
3	6 / 31.6%	10 / 26.3%	
4	2 / 10.5%	4 / 10.5%	
Medication on V2			
1	3 / 16.7%	6 / 15.8%	
2	7 / 38.9%	19 / 50.0%	0.428
3	6 / 333%	8 / 21.1%	
4	1 / 5.6%	5 / 13.2%	
5	1 / 5.6%	-/0.0%	
Medication on V3			
1	5 / 29.4%	6 / 16.2%	
2	4 / 23.5%	16 / 43.2%	0.043
3	6 / 35.3%	9 / 24.3%	
4	-/0.0%	6 / 16.2%	
5	2 / 11.8%	-/0.0%	

V1 - visit 1; V2 - visit 2; V3 - visit 3.

study group and the increase in the control group, especially in the first half. This difference in behavior between the casual measurement and AMBP has already been explained in previous studies for the elimination of the white-coat effect, when BP was assessed by methods monitoring[21,22]. Even in hypertensive subjects followed for a long time in specialized services, the persistence of this effect is a fact and can affect, significantly, one third of patients[23].

The values of glucose, lipid profile and creatinine were similar in both groups at all visits; it is interesting to note that both the SG and CG values were within the targets from the outset and throughout the study.

The results found in the analysis of adherence to non-pharmacological treatment by evaluating the practice of regular physical activity, the adoption of healthy diet according to the orientation of the nutrition team at AHL and control of the habits of regular intake of alcohol and of smoking were not different between groups. In this case, one must consider that the analyzed sample consisted of patients in our center for a long time and that the direction to adopt a healthy lifestyle is routine for these patients. Although such reasoning has a number of limitations and it is not possible to say that in less enlightened people, the results would be different, it is likely that, in this sample, this factor may have affected the result.

In the evaluation of adhesion to the pharmacological treatment, the SG presented at the end of follow-up, 100% of regular use of antihypertensive drugs, whereas in the CG that number was 88.2% ($p = 0.03$). There was also a significant decrease in the number of types of antihypertensive drugs used in the SG compared to CG at visit 3 ($p = 0.04$). These findings are consistent with those of the literature and have been previously shown that when the BP monitoring methods are used to monitor patients for the possibility of identification of white-coat effect, one can achieve better blood pressure control with less need for medications[5,6].

Conclusion

The self measurement of blood pressure in hypertensive patients was able to improve BP control, as assessed by

casual measurement in the first six months of follow-up. However, this difference disappears after 12 months.

No differences were observed between groups in relation to non-pharmacological treatment and the metabolic profile, however, there was greater adherence to drug treatment and reduced need for antihypertensive drugs in the study group.

Limitations of the study

The fact that the sample consisted of patients from a referral center for the treatment of hypertension by effective blood pressure and metabolic control, in which there is comprehensive guidance on the importance of adherence to treatment of hypertension, may have been a limiting factor in order to the major differences between groups to be observed.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

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