Blood Pressure Treatment Adherence and Control Through 24-Hour Ambulatory Monitoring

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Abstract

Background: Although systemic arterial hypertension (SAH) is an important cardiovascular risk factor, blood pressure level control often remains inadequate. Assessment of adherence to antihypertensive treatment through 24-hour ambulatory blood pressure monitoring (ABPM) may represent an important aid in the search for BP control targets.

Objective: To assess adherence to antihypertensive treatment and its association with BP values at 24-hour ABPM in hypertensive patients treated in primary health care (PHC) centers.

Methods: We carried out a cross-sectional study of 143 hypertensive patients, who constituted a representative sample of patients from PHC centers in the town of Antonio Prado, RS. The Morisky-Green test was used to evaluate adherence and verify the number of medications used by patients, followed by 24-hour ABPM.

Results: We observed that 65.7% of the sample was considered adherent to the proposed treatment, 20.3% were moderately adherent and only 14% were classified as non-adherent. Considering all the 143 patients evaluated, 79 (55.2%) were identified as having controlled hypertension (<130/80 mmHg) according to the 24-hour ABPM measurements, 64 (44.8%) were considered uncontrolled (>130/80 mmHg), 103 (72%) had absence of nocturnal BP dip and 60 (41.9%) were uncontrolled while awake.

Conclusion: In this study, we observed a lack of adequate hypertension control with a consequent loss of opportunity for PHC professionals to adequately adjust the recommended BP control targets. This fact occurs in spite of proper adherence to antihypertensive treatment by patients in PHC centers (Arq Bras Cardiol. 2013;100(4):347-353).

Keywords: Blood Pressure; Blood Pressure Monitoring, Ambulatory; Hypertension; Medication Adherence.

Introduction

Systemic arterial hypertension (SAH) is the most important independent risk factor for mortality[1] and the main modifiable risk factor for cardiovascular disease (CVD)[2], with a prevalence of one billion hypertensive individuals worldwide and responsible for approximately 7.6 million deaths per year[3,4]. However, approximately 40% of hypertensive patients do not receive antihypertensive treatment and two-thirds of the treated ones do not reach blood pressure (BP) control goals (<140/90 mmHg). Thus, although the association between high cardiovascular risk and SAH is well defined, only a small number of patients using antihypertensive medication reach the BP control goals[5]. In Brazil, hypertensive patients enrolled in of basic health units (BHU) hypertension programs showed only 39% of BP control (<140/90 mmHg) and 33% of these patients were classified as having stage 2 or 3 hypertension (BP> 160 / 110 mmHg)[6].

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Manuscript received March 29, 2012; revised manuscript April 02, 2012; accepted October 24, 2012.

DOI: 10.5935/abc.20130046

The low rates of adherence to the proposed drug therapy are a major cause of inadequate hypertension control[7]. Definitely, hypertensive individuals who abandoned treatment had a three-fold increased risk of acute coronary syndrome when compared with patients who maintained the antihypertensive treatment[8]. One can also observe the importance of non-adherence to antihypertensive treatment as one of the factors responsible for the high rates of cerebrovascular disease in our country[9].

The rates of adherence to antihypertensive treatment in Brazil vary between 23% and 62.1%10-12. These data derive primarily from studies using indirect methods of adherence assessment, due to their low cost and implementation feasibility. Nevertheless, the use of auxiliary methods of BP measurement and their association with drug treatment adherence has not been broadly adopted in primary health care (PHC)[13].

The aim of the present study was to estimate the association between adherence to antihypertensive drug treatment and BP measurement control performed by 24-hour ambulatory BP monitoring (ABPM) in hypertensive patients enrolled in the Hiperdia program of basic health units (BHU) in a small town in southern Brazil.

Methods

Participants

Participants in this cross-sectional study were hypertensive patients living in Antonio Prado (RS), a small town in southern Brazil with 12,837 inhabitants[6]. Patients were enrolled from the Family Health Program and the Hiperdia Program (computerized system that allows the registration and monitoring of patients with hypertension and diabetes in the National Health System) from the town's basic health units, from January 2009 to December 2010. Hypertensive individuals, aged 18 and older, who were receiving antihypertensive medication in the last three months were invited to participate in the study by their physicians during a routine consultation at the hypertension outpatient clinic. Patients who were not able to answer the questionnaire, pregnant women, patients with non-sinus rhythm at the electrocardiogram and those residing outside the coverage area of the health units were excluded.

All participants in the study agreed to participate and signed the consent form. The results of biochemical tests performed during the study were given to patients. The project was approved by the Research Ethics Committee (REC) of IC/FUC - 4278.08.

BP conventional measurement

The basic health unit (BHU) physician obtained three BP measurements with a mercury sphygmomanometer, using a cuff of appropriate size, with the patient in the sitting position and after 5 minutes of rest. The BHU physicians were instructed to perform measurements on both arms, using the highest BP value as reference after a 3-minute interval between measurements. The first measurement was excluded and then the mean of the two subsequent measurements was calculated. Soon after, at the same visit, the patient was assessed by a nurse trained for the research. A questionnaire was applied containing the study validated instruments, a 12-lead electrocardiogram was performed with subsequent medical report prepared by the medical researcher and ABPM placement during a normal day of work activity of the patient, excluding weekends and holidays.

Blood pressure Monitor and measurements

Monitors were used after being properly validated and calibrated, approved by the British Hypertension Society[14]. The ABPM device was DMS Brasil TM 2430 model and the mercury sphygmomanometer was an MDF 800 model. The 24-hour ABPM measurements were performed every 15 minutes during the waking period and every 30 minutes during sleep, adjusted after patients were questioned about their usual time of sleep and waking. Data were considered adequate when there was a minimum of 70 records in a 24-hour period, with at least two records every hour during the nocturnal period. The parameters evaluated by ABPM were: 24-hour mean systolic and diastolic BP, daytime and nighttime systolic and diastolic BP. Hypertension measured by a conventional sphygmomanometer was defined as values ≥ 140/90 mmHg. Uncontrolled hypertension using ABPM as a criterion was considered when there were values for 24-hour mean > 130/80 mmHg.

For the waking period values, uncontrolled BP was defined when the mean remained > 130/85 mmHg. Lack of nocturnal dip was defined as a reduction in BP at ABPM ≤ 10% from the mean daytime. White-coat hypertension (WCH) was considered as the condition in which BP is higher when measured at the medical office, but controlled in other situations15. Masked hypertension (MH) is the clinical situation in which a conventional BP measure is normal, but high on ABPM or home measurements[16]. Current clinical guidelines do not have clear cutoff values to define 24-hour BP normality; thus the same values were considered between diabetic and non-diabetic individuals.

The adherence evaluation test used was the one by Morisky et al.[17], adapted and validated for the Portuguese language[8]. The following questions were used: Do you ever forget to take your medication?; Are you sometimes careless about the time you take your medication?; When you feel better, do you sometimes stop taking the medication?; When you feel bad due to the medication, do you sometimes stop taking it? Patients were considered adherent when answered 'no' to all questions. Adherence was considered to be moderate when the patient responded affirmatively to one or two of the four questions of this questionnaire. In addition to using the test by Morisky et al[17], we evaluated the number of medications used by the patient through their self-report and medical record verification.

Medical records were reviewed and the following tests were requested by the investigator: total cholesterol, HDL-c, triglycerides, LDL-c, creatinine, potassium, high-sensitivity C-reactive protein (hs-CRP), fibrinogen, complete blood count, glycated hemoglobin A1c fraction, glycemia and microalbuminuria. The following were also assessed: body weight, height, body mass index, waist / hip ratio, smoking status and alcohol consumption[18].

Statistical methods

The entry and analysis of data were performed using SPSS 17.0. Descriptive statistics with continuous and categorical variables was performed. The statistical Chi-square test was used to evaluate adherence to drug treatment using the test by Morisky et al.[17] and number and type of medications with the results of uncontrolled BP by 24-hour ABPM; values were considered significant with $p < 0.05$.

To estimate the agreement between two methods of BP measurement, a probability of BP control of 30% and 10% was considered, respectively, for ABPM and conventional measurement. The confidence interval was 95% with 80% power. The estimated sample size was 142 patients. The sample was considered representative of the PHC service in the town of Antônio Prado (RS), as it was randomly selected at two basic health units that have the Hiperdia Outpatient Program, of a total of 646 patients enrolled in this system.

Results

Between January 2009 and December 2010, from a consecutive sample of 146 hypertensive patients enrolled in the Hiperdia program was collected from two basic health units in the town of Antônio Prado (RS), of a total of 618 patients. Of these 146, three patients were excluded from the analysis, as they abandoned the follow-up protocol. ABPM was performed in the remaining 143 patients, shortly after BP measurements were obtained at the office, with data considered appropriate in all tests. The study population consisted primarily of women (67%), Caucasians (79.6%) with a mean age of 59.8 years. Additionally, 21% were diabetics, 63.6% had hypercholesterolemia, 9.2% were smokers, 16.1% consumed alcohol and 32.6% were obese (Table 1). All participants were receiving antihypertensive medications and the main class of drugs used was angiotensin-converting enzyme inhibitors (ACEI; Figure 1).

Of the total of 143 patients assessed, 79 (55.2%) were identified as controlled SAH (<130/80 mmHg) according to the 24-hour ABPM measurements, 64 (44.8%) were uncontrolled (> 130/80 mmHg), 103 (72%) had lack of nocturnal BP dip and 60 (41.9%) were uncontrolled during the waking period (Figure 2). When considered the prevalence of white-coat hypertension and masked hypertension in the sample of hypertensive patients, values of 29.37% and 12.58% were found, respectively. The agreement between BP measurements at the office and 24-hour ABPM in the classification of controlled BP had a kappa value of 0.198 for systolic blood pressure (SBP) and 0.09 for diastolic blood pressure (DBP). The agreement between the two methods for controlled BP had a kappa value of 0.07.

When evaluating the classification of Morisky et al17 for medication adherence, 65.7% (94 patients) of the sample were considered adherent to the proposed treatment, while 20.3%

Table 1 – Descriptive characteristics of the sample

Variables	N (%) or mean (standard deviation)
Demographic variables	
N	143
Female sex	96 (67%)
Age	59.8 (± 12.7)
Caucasians	113 (79.6%)
Diabetics	30 (21%)
Inflammatory markers	
CRP	4 (± 5.7)
Fibrinogen	369.3 (± 87.3)
Metabolic descriptors	
Glycated hemoglobin A1C (%)	6.19 (± 1.26)
Fasting glucose (mg/dL)	101 (± 32.5)
Microalbuminuria (mg/g creatinine)	91.9 (± 438.4)
Lipid variables	
Total cholesterol (mg/dL)	212.55 (± 39.7)
HDL (mg/dL)	49.15 (± 12.6)
LDL (mg/dL)	130.7 (± 35.6)
Triglycerides (mg/dL)	164.13 (± 91.4)
Anthropometric data	
BMI, kg/m^2	27.98 (± 5.12)
Normal	30.5%
Overweight	36.9%
Obesity	32.6%
Waist/hip	1.52 (± 6.6)
Lifestyle	
Smokers	13 (9.2%)
Alcohol consumption > 5 doses/day	23 (16.1%)

CRP: C-reactive protein; BMI: body mass index.

(29 patients) were moderately adherent and 14% (20 patients) were classified as non-adherent. There was no statistically significant association between the findings regarding the association between the classification by Morisky et al.[17] and uncontrolled BP by 24-hour ABPM (p = 0.61, Table 2). Additionally, when considering the number of medications used and uncontrolled BP by ABPM, no association was found between the variables (p = 0.41, Table 3).

Discussion

Chronic-degenerative diseases have become major causes of death in developed and developing countries, after basic health improvements achieved in the last century[19]. This epidemiological transition started in Brazil in the mid-1940s[20,21]. Cardiovascular diseases (CVD) stand out as responsible for the leading cause of worldwide mortality[22,23] and Brazil is included in this context[24].

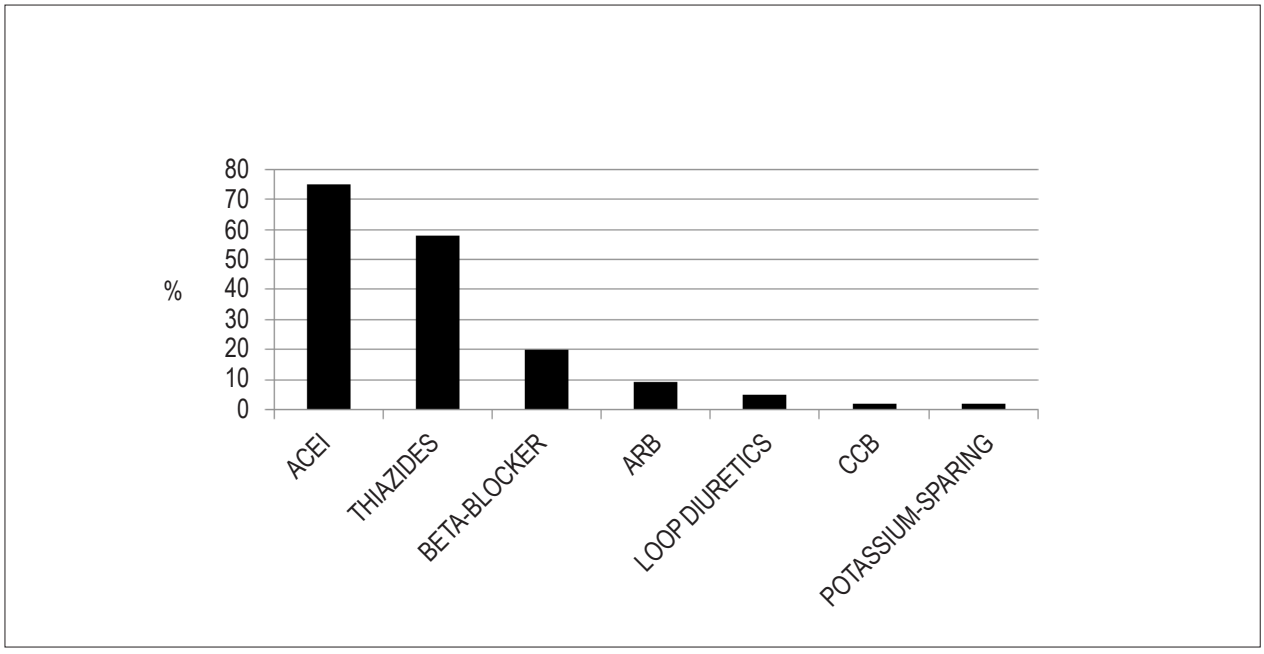

Figure 1 – *Antihypertensive medications used in PHC, Antônio Prado (2011).*
PHC: primary health care; CCB: calcium channel blocker; ARB: angiotensin receptor blocker); ACEI: angiotensin converting enzyme inhibitor.

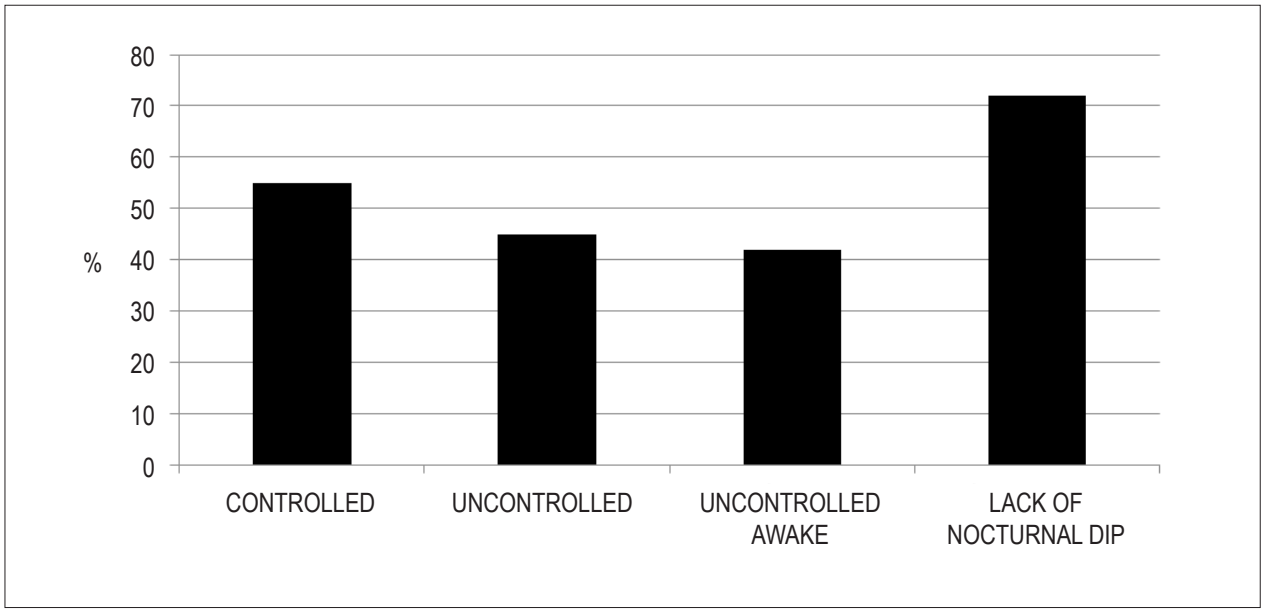

Figure 2 – *24-hour ABPM measurements, Antônio Prado (2011).*

Table 2 – Adherence to drug treatment and 24-hour ABPM results

	ABPM values > 130/80 mmHg*	
Adherence	**No**	**Yes**
Adherent	60.6%	39.4%
Moderately adherent	48.3%	51.7%
Non-adherent	40%	60%

**Values considered abnormal for 24-hour ABPM.*

Table 3 – Number of medications used and 24-hour ABPM results

	ABPM values >130/80 mmHg	
N. of medications	**No**	**Yes**
1 to 3	57%	43%
4 or more	45.5%	54.5%

The present study evaluated patients with hypertension in a PHC setting, using ABPM as a reference tool to assess BP control and direct questioning to the patient through the instrument to assess adherence to the proposed therapy developed by Morisky et al.[17]. This method is best used to assess the lack of adherence to drug treatment, as it has practical, feasible and low-cost applicability[25]. There was no association between adherence to antihypertensive treatment and controlled BP as recorded by 24-hour ABPM. Additionally, when evaluating the number of medications used by patients, there was no association between polypharmacy and 24-hour mean BP control. This finding differs from those in the literature, which show the greater the number of medications used, the lower the adherence. One possible explanation for this finding is the social and multidisciplinary support provided by the municipal BHUs, which includes support from psychology and social work professionals.

The main result of the present study was that, although the patients in this sample were mostly adherent or moderately adherent to the antihypertensive treatment, their uncontrolled BP values, measured by 24-hour ABPM, showed no statistically significant association with treatment adherence. It was observed that 65.7% of the sample was considered adherent to the proposed treatment, while 20.3% were classified as moderately adherent. Among some studies that used test developed by Morisky et al.[17] as adherence assessment method, adherence rates ranged between 60.3%[26] and 76.8%[27]. When the same test was used to assess adherence having BP control as the reference or gold standard, adherence ranged from 23%[10] to 48.1%[12].

Additionally, in a study by Renet et al.[28], medical recommendations made by medical specialists were followed less frequently than those made by primary care physicians. The prevalence of adherence using the test by Morisky et al.[17] in the present study was similar to that of current literature; however, there was no correlation between greater adherence to antihypertensive treatment and lower blood pressure levels and significant reductions in BP[7], as expected. Regarding the findings of the present study on BP control goals that were not attained despite adequate adherence to the proposed treatment, it is noteworthy the active participation of patients regarding their careful medication use, requiring more effective intervention in the management of hypertension by physicians working in PHC settings.

This result suggests the inadequacy of antihypertensive drug prescriptions where the adoption of protocols and guidelines for the treatment of hypertension could play an important role in achieving BP control goals[29]. Another aspect to be suggested is the inclusion of a multidisciplinary guideline for the treatment of hypertension, including nutritional counseling, physical activity and psychological support for proper stress management.

Concerning polypharmacy, our study also showed no association between the number of medications taken daily and inappropriate BP control. These findings contradict most of the studies linking the use of several drugs as an adverse factor for medication adherence[30]. Thus, the daily use of several medications can be seen as a major reason of therapy adherence interference[31], unlike the findings of this study.

The findings of the 24-hour ABPM showed a total of 44.8% of uncontrolled hypertensive individuals (> 130/80 mmHg), 72% with absence of nocturnal BP dip and 41.9% with uncontrolled BP during the waking period, demonstrating a large number of insufficiently treated hypertensive patients. This finding is consistent with those in the literature, which shows inappropriate use of antihypertensive medications[2].

The literature draws attention to the economic investment and availability of time when searching for effective medications to treat hypertension, without the same commitment regarding the concern whether patients actually use them[31]. The implications in clinical practice of the findings of our study demonstrate that comparisons between BP measurements carried out by ABPM and its association with adherence to drug treatment

have shown that most patients followed the therapeutic recommendations proposed by their doctors; however, they did not reach the hypertension control goal. Moreover, one must emphasize the importance of the fact that physicians treating patients with hypertension in the primary care environment can have a major role in helping them reach BP control goals.

One limitation of this study was the performance of only one 24-hour ABPM measurement, which could interfere with the reproducibility of measurements, particularly for the nocturnal BP dip. However, measures were taken prior to the implementation of ABPM, such as the individualized adequacy of sleep-wake cycle and the accuracy of the 24-hour measurements obtained. When considering the sample, the universe of patients involved in the study is representative of hypertensive patients treated at PHC services. Additionally, PHC physicians were encouraged to refer patients to participate in this study. This attitude characterizes a population-based study and all patients with this diagnosis were encouraged to participate.

Thus, population-based studies are important in the search for new public and social health policies by adopting healthy choices regarding the inclusion of the largest possible number of individuals at optimal and acceptable cardiovascular risk levels[31].

The observations made in this study indicate that there are evaluation problems regarding the medical perception of the meaning of controlled BP in PHC settings. Thus, we observed the limited control of SAH and loss of opportunity by medical professionals to achieve a better BP adjustment. This is an important fact, as we are faced with a sample of patients that are highly adherent to medical guidelines. Therefore, this study supports the recommendations of greater attention in terms of medical training and the implementation of hypertension guidelines aiming at improving the quality of health care services provided to the hypertensive patient in the PHC setting.

Author contributions

Conception and design of the research, Acquisition of data, Analysis and interpretation of the data, Statistical analysis, Writing of the manuscript and Critical revision of the manuscript for intellectual content: Grezzana GB, Pellanda LC, Stein AT; Obtaining funding: Grezzana GB.

Potential Conflict of Interest

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

Sources of Funding

There were no external funding sources for this study.

Study Association

This article is part of the thesis of master submitted by Guilherme Brasil Grezzana, from Instituto de Cardiologia do Rio Grande do Sul - Fundação Universitária de Cardiologia.

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