JAMDA xxx (2015) 1–6

JAMDA

journal homepage: www.jamda.com

Original Study

Impact of Ambulatory Blood Pressure Monitoring on Control of Untreated, Undertreated, and Resistant Hypertension in Older People in Spain

Teresa Gijón-Conde MD [a,b], Auxiliadora Graciani MD [a], Esther López-García PhD [a], Pilar Guallar-Castillón MD [a], Fernando Rodríguez-Artalejo MD [a], José R. Banegas MD [a,*]

[a] *Department of Preventive Medicine and Public Health, School of Medicine, Universidad Autónoma de Madrid/IdiPAZ – CIBER in Epidemiology and Public Health (CIBERESP), Madrid, Spain*
[b] *Centro de Salud Universitario Cerro del Aire, Majadahonda, Madrid, España*

Keywords:
Hypertension
control
treatment
ambulatory blood pressure monitoring
epidemiology
aged

A B S T R A C T

Background and objective: The impact of ambulatory blood pressure monitoring (ABPM) on hypertension control has not been fully assessed across the treatment spectrum in older community-living individuals and could have important implications; specifically, the number of untreated, undertreated, and treatment-resistant uncontrolled hypertensives in need of or with unnecessary drug treatment could vary with respect to studies based on conventional blood pressure (BP) measured in clinical settings.
Design, setting, and participants: Cross-sectional study conducted in 2012 among 1118 community-living individuals aged ≥60 years in Spain.
Measurements: Three conventional BP measurements at participants' homes and 24-hour ABPM were performed under standardized conditions. Uncontrolled hypertension (mean of the last 2 conventional BP readings ≥140/90 mm Hg) was considered undertreated if on 1 or 2 antihypertensive drugs, and apparently treatment-resistant if on ≥3 drugs. White-coat effect was defined as conventional BP ≥ 140/90 mm Hg and 24-hour BP <130/80 mm Hg.
Results: Of 720 hypertensive patients (mean age, 72.3 ± 6.3 years; 51.3%, males), 64.4% had conventional BP ≥ 140/90 mm Hg, and from these 39.9% were untreated, 49.5% undertreated, and 10.6% apparently treatment-resistant. Among uncontrolled hypertensive patients, the white-coat effect was present in 52.4% of those untreated, in 53.5% of undertreated, and in 49% of apparent treatment-resistant. These white-coat results were similar or even higher across alternative BP thresholds.
Conclusions: One-half of older uncontrolled hypertensive patients studied at home were actually controlled according to ABPM, regardless of treatment status. This suggests reconsideration of treatment needs in these numerous white-coat hypertensive patients, who probably do not need drug treatment initiation or intensification.

Hypertension is a serious public health threat because it is highly prevalent in many developed and developing countries, especially in older people.[1–4] As a consequence, hypertension is the leading risk factor for global disease burden, accounting for 7.6 million premature deaths and 7% of disability-adjusted life years worldwide.[1,5] Although hypertension is easily detectable and can be controlled with appropriate treatment, the degree of blood pressure (BP) control remains poor in most populations and settings.[3,4,6–9]

Numerous factors are responsible for low hypertension control.[10] Many hypertensive patients remain unidentified or untreated.[3,4,6–8] Another major factor is inadequate management of patients by their health care professionals and poor compliance by patients to prescribed treatment.[11,12] The most challenging factor in clinical settings is treatment-resistant hypertension (lack of control on at least 3 BP medications).[13,14]

Financial disclosure: Data collection was funded by Fondo de Investigación Sanitaria (FIS) grants 09/1626 and 12/1166 (Ministry of Health of Spain) and by the 'Cátedra UAM de Epidemiología y Control del Riesgo Cardiovascular'. Specific funding for this analysis was obtained from FIS grant PI13/02321. The sponsors had no role in study design, the collection, analysis and interpretation of data, the writing of the report, and the decision to submit the article for publication.

* Address correspondence to José R. Banegas, MD, Department of Preventive Medicine and Public Health, School of Medicine, Universidad Autónoma de Madrid, Arzobispo Morcillo 2, 28029 Madrid, Spain.
E-mail address: joseramon.banegas@uam.es (J.R. Banegas).

http://dx.doi.org/10.1016/j.jamda.2015.03.004
1525-8610/

A recent study has quantified uncontrolled hypertension and reported differential characteristics in uncontrolled patients based on their treatment status (untreated, undertreated, treatment-resistant), which suggests that specific strategies may be appropriate for each treatment group to improve BP control.[15] These findings were based on conventional BP measurements. However, ambulatory BP monitoring (ABPM) can remove the white-coat effect, estimate the true, or mean, BP level and BP control, and predict clinical outcomes better than conventional BP measurements.[16–19]

Some studies have assessed the impact of ABPM on the frequency of treatment-resistant hypertension in clinical settings.[14,20,21] However, the impact of ABPM on hypertension control has not been fully assessed across the treatment spectrum in older community-living populations, especially in studies conducted at the participants' homes. This could have important treatment implications; specifically, the impact of ABPM on the number of untreated, undertreated, and treatment-resistant uncontrolled hypertensives in need of or with unnecessary drug treatment could vary with respect to studies based on conventional BP measured in clinical settings. The objective of this study was to estimate the frequency of uncontrolled hypertension according to the treatment or treatment-resistance status, and to assess how this frequency changes with conventional BP or ABPM in older community-living individuals studied at their homes in Spain.

Methods

Study Design and Population

We conducted a cross-sectional analysis on the second wave of the Seniors-ENRICA (National Nutrition and Cardiovascular Risk Survey) study, a cohort set up in 2008–2010 with individuals selected through random sampling from the population aged 60 years and older in Spain.[7,22] This second wave was conducted in 2012 among 2519 individuals alive and included a phone interview on health status, lifestyle, and morbidity, as well as a home visit to record BP and anthropometry, habitual diet, and prescribed medication.

Because of logistic and cost reasons, ABPM was offered to 1698 individuals and was performed in 1328 participants (response rate, 78.2%). Compared with participants without ABPM, those who underwent it had similar age, proportion of gender, education levels, mean body mass index (BMI), diabetes, current smoking, and previous history of cardiovascular disease (data not shown).

Study participants gave written informed consent. The study was approved by the Clinical Research Ethics Committee of the "La Paz" University Hospital in Madrid.

BP Measurement

BP was measured at participants' homes by certified trained personnel using standardized procedures and conditions,[23,24] with validated automatic devices (Omron M6; Omron Healthcare, Kyoto, Japan) and appropriate sized cuffs. BP was determined 3 times at 2-minute intervals, after resting 5 minutes in a seated position. In the analyses, BP was calculated as the mean of the last 2 of the 3 readings. Thereafter, 24-hour ABPM was performed using a validated automated noninvasive oscillometric device (Microlife WatchBPO3 monitor; Microlife Corp, Widnau, Switzerland),[25] programmed to register BP at 20-minute intervals during the day and at 30-minute intervals during the nighttime for the 24-hour period. Appropriate cuff sizes were used. The majority of registries were performed on working days, and the patients were instructed to maintain their usual activities but keeping the arm extended and immobile at the time of cuff inflation. The staff of the study returned to the patients' homes for device removal the following day. Valid ABPM registries had to fulfill a series of pre-established criteria, including 24-hour duration and at least 70% of systolic BP (SBP) and diastolic BP (DBP) successful recordings during the daytime and night-time periods.[24,26] Daytime and night-time periods were defined individually according to the patient's self-reported time of going-to-bed and getting-up.

Based on conventional BP, hypertension was defined as SBP $\geq$ 140 mm Hg, DBP $\geq$ 90 mm Hg, or currently taking prescribed antihypertensive medication.[23,24,26] Treated hypertension was considered as an affirmative answer to the following questions: "Were you prescribed an antihypertensive medication by your physician?" and "Are you currently taking this BP medication?" Among treated hypertensive, BP control was defined as SBP $<$140 and DBP $<$90 mm Hg.[23,24,27] We chose this threshold because (1) it corresponds to the universal definition of hypertension for all ages at the time of the survey, (2) BP was taken in only 1 occasion by personnel not involved with the participants and with a technique similar to office BP, and (3) it has a consensus ABPM equivalent (130/80 mm Hg for 24-hour BP).[23,24,26,27] Accordingly, 24-hour ambulatory control was defined as mean 24-hour SBP $<$130 mm Hg and DBP $<$80 mm Hg, ambulatory diurnal control was defined as mean diurnal SBP $<$135 mm Hg and DBP $<$85 mm Hg, and ambulatory nocturnal control was defined as mean nocturnal SBP $<$120 mm Hg and DBP $<$70 mm Hg.[24,26]

Other Variables

Study participants reported their age, smoking status, and number of primary care visits in the past year. Medical advices on physical activity, diet, or salt intake were also reported. Medical advice was considered as an affirmative answer to the following questions: "Have you received information about physical activity, diet, or salt intake from your nurse or physician? Weight and height were measured in each participant under standardized conditions. BMI was calculated as weight in kilograms divided by height square in meters. Obesity was defined as BMI $\geq$ 30 kg/m^2.

Participants also reported if they had ever been diagnosed of diabetes, hyperlipidemia, and cardiovascular disease. Medication use was collected by a face-to-face interview and verified against drug packaging during the home visits. Antihypertensive medications were classified according to international guidelines.[23,24]

Statistical Analyses

There were 1118 individuals with $\geq$70% valid ABPM readings and complete information on study variables (84.2% of all with available ABPM). Of these, 720 were hypertensive according to conventional BP. We calculated BP control and classified uncontrolled hypertensive patients ($\geq$140/90 mm Hg) according to antihypertensive drug treatment in 3 groups: (1) untreated, (2) taking 1 or 2 drugs (undertreated patients), and (3) concurrent use of $\geq$3 different drugs (apparent treatment-resistant hypertension) (aTRH).[13,15] More than 90% of the latter were taking a diuretic.

We then calculated the proportion of patients with white-coat effect (conventional BP $\geq$ 140/90 mm Hg and ambulatory BP $<$130/80 mm Hg)[24,26] in the 3 treatment groups. True treatment-resistant hypertension was defined in patients with aTRH if mean 24-hour BP was $\geq$130/80 mm Hg.

We ran several sensitivity analyses to assess the robustness of the main results. Specifically, despite conventional BP at home was only measured on 1 occasion, we also used the BP threshold of 135/85 mm Hg to define hypertension based on multiple BP readings at home over several days[28] and compared it with ambulatory daytime BP. We made an additional analysis using the recently proposed clinic BP goal of 150/90 mm Hg for older people,[29] and approaching its 24-hour BP equivalent as 140/90 mm Hg.[30]