Journal of the American Society of Hypertension 10(3) (2016) 224–234

Research Article

Studies comparing ambulatory blood pressure and home blood pressure on cardiovascular disease and mortality outcomes: a systematic review

Daichi Shimbo, MD[a,*], Marwah Abdalla, MD[a], Louise Falzon[a], Raymond R. Townsend, MD[b], and Paul Muntner, PhD[c]

[a]*Department of Medicine, Columbia University Medical Center, New York, NY, USA;*
[b]*Department of Medicine, Perelman School of Medicine, University of Pennsylvania, PA, USA; and*
[c]*Department of Epidemiology, University of Alabama at Birmingham, Birmingham, AL, USA*

Manuscript received November 12, 2015 and accepted December 16, 2015

Abstract

Ambulatory blood pressure monitoring (ABPM) is more commonly recommended for assessing out-of-clinic blood pressure (BP) than home blood pressure monitoring (HBPM). We conducted a systematic review to examine whether ABPM or HBPM is more strongly associated with cardiovascular disease events and/or mortality. Of 1007 abstracts published through July 20, 2015, nine articles, reporting results from seven cohorts, were identified. After adjustment for BP on HBPM, BP on ABPM was associated with an increased risk of outcomes in two of four cohorts for systolic blood pressure and two of three cohorts for diastolic blood pressure. After adjustment for BP on ABPM, systolic blood pressure on HBPM was associated with outcomes in zero of three cohorts; an association was present in one of two cohorts for diastolic blood pressure on HBPM. There is a lack of strong empiric evidence supporting ABPM or HBPM over the other approach for predicting cardiovascular events or mortality. J Am Soc Hypertens 2016;10(3):224–234.

Keywords: Ambulatory blood pressure monitoring; hypertension; home blood pressure monitoring.

Introduction

To identify patients with hypertension and monitor their blood pressure (BP) while taking antihypertensive medication, most guidelines and scientific statements recommend measuring BP in the clinic setting.[1–5] This recommendation is supported by extensive data, which have demonstrated that elevated clinic BP is associated with increased cardiovascular disease (CVD) risk, and lowering of clinic BP with antihypertensive medication is associated with a proportional reduction in risk.[1–5]

Data have been published demonstrating that BP may differ substantially when measured outside versus in the clinic setting.[6–8] There are two well-accepted approaches for measuring BP outside the clinic setting: ambulatory blood pressure monitoring (ABPM) and home blood pressure monitoring (HBPM). Higher BP on ABPM and HBPM has each been shown to be associated with an increased risk of CVD events and mortality independent of clinic BP.[9,10]

Recent guidelines including from the US Preventive Services Task Force (USPSTF)[4,5,11–14] have recommended the assessment of out-of-clinic BP using ABPM over HBPM. However, there is controversy about which method, ABPM or HBPM, is superior for measuring out-of-clinic BP and assessing BP-related CVD risk.[15–17] We conducted

This work was supported by the National Institutes of Health (HL047540, HL117323, HL117323-02S2, K24-HL125704) from the National Heart, Lung, and Blood Institute, Bethesda, MD. The funding source had no role in the study design, collection, analysis, interpretation, or drafting of the manuscript or in the decision to submit the manuscript for publication.

Conflicts of interest: P.M. received an institutional grant from Amgen Inc. unrelated to the topic of the present manuscript. R.R.T. reports grant support from Fukuda Denshi unrelated to the present manuscript. There are no other potential conflicts of interest.

Supplemental Material can be found at www.ashjournal.com.

*Corresponding author: Daichi Shimbo, MD, Columbia University Medical Center, 622 West 168th Street, PH 9-310, New York, NY 10032. Tel.: (212) 342-4490; Fax: (212) 342-3431.

E-mail: ds2231@cumc.columbia.edu

1933-1711/$ - see front matter
http://dx.doi.org/10.1016/j.jash.2015.12.013

a systematic review of published studies to provide an objective assessment of whether BP from ABPM or from HBPM is more consistently associated with CVD events and/or mortality.

Methods

Search Strategy and Selection Criteria

Articles were included if they met the following criteria: (1) included participants aged ≥18 years; (2) conducted both ABPM and HBPM; and (3) had follow-up for CVD events and/or mortality. We excluded articles that only reported results from cross-sectional analyses, review articles, letters to the editor, commentaries, editorials, or meeting abstracts. There was no restriction on language, sample size, or duration of follow-up. When two articles reported the results from the same cohort, the one with more person-years of follow-up or more outcomes (either number or type of outcomes) was included. However, if two articles from the same cohort reported different ABPM or HBPM phenotypes (eg, one study reported mean BP and another study reported white-coat hypertension) or outcomes (eg, one study reported CVD and another study reported all-cause mortality) or modeled the same phenotype differently (eg, daytime systolic blood pressure [SBP] modeled as a continuous variable in one article and modeled in categories in a separate article) on the same population, both were included.

The following databases were searched through July 20, 2015: MEDLINE, EMBASE, and CENTRAL. The MEDLINE search strategy is described in the online Data Supplement (Supplemental Methods). Terms for the other databases were adapted accordingly. To supplement the database searches, a PubMed-related articles search and a cited reference search through ISI Web of Science were conducted using the included articles identified from the first set of results. A manual search was also performed using the reference lists from the included articles and review articles produced by the electronic database searches.

Two investigators (D.S. and M.A.) independently reviewed all identified articles for eligibility using the above criteria. The title and abstract of identified articles were reviewed, and those deemed ineligible were excluded. The full text for the remainder of articles was retrieved and reviewed. Discrepancies on whether to include a study were resolved by discussion with a third investigator (P.M.).

Data Extraction

Data were independently abstracted from all articles by two investigators (D.S. and M.A.) using a standardized instrument. Study characteristics (publication year, cohort name, first author, sample size, population characteristics, location including city and country of origin, outcomes, and follow-up period), BP measurement methodology (device, number and frequency of readings, and duration of monitoring), and results (eg, hazard ratios) from the most fully adjusted models were abstracted for the study population. The quality of data abstraction was monitored by comparing the forms of the data abstractors. Discrepancies in data abstraction were resolved by discussion with a third investigator (P.M.), as needed. The articles varied by participant and sample characteristics, BP measurement technique, and outcomes. Therefore, the results of the studies meeting the inclusion criteria were not pooled due to substantial clinical and methodological heterogeneity.

Results

Identification of Articles

The original search identified 545 abstracts (Figure 1). After review of the title and abstract, 520 abstracts were excluded. Of the 25 full-text articles retrieved, 17 were excluded, leaving eight original articles. An additional three potentially relevant articles were identified from a manual search of the reference lists from these articles. An additional 462 abstracts were identified in a supplemental search of other sources (reference lists, related articles search, citations). No articles were selected from this supplemental search. Of the 11 potentially relevant articles, one article[18] was excluded based on duplicate results discovered on data extraction, and another article[19] was excluded because it reported results using fewer outcomes than another article from the same cohort.[20] In total, nine articles[20–28] met the inclusion/exclusion criteria for data abstraction. Of these articles, six reported data from separate cohorts,[20–24,28] and three reported data from the Pressioni Arteriose Monitorate e Loro Associazioni cohort.[25–27] In total, data were available from seven cohorts.

Study Characteristics

The earliest[24] and most recent[28] identified articles were published in 1996 and 2014, respectively (Table 1). Sample sizes ranged from 150 to 2051 participants. The articles included participants from the general population,[24–27] a clinic population sample,[23] participants with either chronic kidney disease or ESRD,[20–22] and a mixed population of participants from the general population and clinical practice.[28] Outcomes included all-cause mortality[20,21,24–27]; CVD death[20,25–27]; a composite of stroke, myocardial infarction, and CVD death[23]; a composite of stroke, myocardial infarction, and all-cause mortality[22]; and a composite of CVD mortality, myocardial infarction, stroke, heart failure hospitalization, and coronary revascularization.[28]