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Association of an inter-arm systolic blood pressure difference with all-cause and cardiovascular mortality: An updated meta-analysis of cohort studies

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ABSTRACT

Objective: To evaluate whether an association exists between an inter-arm systolic blood pressure difference (sIAD) and all-cause and cardiovascular mortality.
Methods: We searched for cohort studies that evaluated the association of a sIAD and all-cause or cardiovascular mortality in the electronic databases Medline/PubMed and Embase (August 2014). Random effects models were used to calculate pooled hazard ratios (HRs) and 95% confidence intervals (CIs).
Results: Nine cohort studies (4 prospective and 5 retrospective) enrolling 15,617 participants were included. The pooled HR of all-cause mortality for a sIAD of ≥10 mm Hg was 1.53 (95% CI 1.14–2.06), and that for a sIAD of ≥15 mm Hg was 1.46 (1.13–1.88). Pooled HRs of cardiovascular mortality were 2.21 (95% CI 1.52–3.21) for a sIAD of ≥10 mm Hg, and 1.89 (1.32–2.69) for a sIAD of ≥15 mm Hg. In the patient-based cohorts including hospital- and diabetes-based cohorts, both sIADs of ≥10 and ≥15 mm Hg were associated with increased all-cause (pooled HR 1.95, 95% CI 1.01–3.78 and 1.59, 1.06–2.38, respectively) and cardiovascular mortality (pooled HR 2.98, 95% CI 1.88–4.72 and 2.10, 1.07–4.13, respectively). In the community-based cohorts, however, only a sIAD of ≥15 mm Hg was associated with increased cardiovascular mortality (pooled HR 1.94, 95 % CI 1.12–3.35).
Conclusions: In the patient populations, a sIAD of ≥10 or of ≥15 mm Hg could be a useful indictor for increased all-cause and cardiovascular mortality, and a sIAD of ≥15 mm Hg might help to predict increased cardiovascular mortality in the community populations.

1. Introduction

The guidelines for the management of hypertension highlight that blood pressure (BP) of both arms should be measured in order to evaluate inter-arm BP difference (IAD), and to better identify and manage hypertension [1,2]. Usually, an increased systolic IAD (sIAD) is defined as 10 mm Hg or more [3]. A meta-analysis on 4 cross-sectional studies of opportunistic populations at low risk of bias showed a pooled prevalence of 19.6% for a sIAD of ≥10 mm Hg [4]. The existing data based on angiographic and ultrasonographic imaging indicate that a sIAD of ≥10 mm Hg, especially a sIAD of ≥15 mm Hg, is a useful sign for subclavian and brachial arterial stenosis [5–9]. In addition, an increased sIAD is also associated with an increased risk for subclinical atherosclerosis, left ventricular hypertrophy [10,11], aortic aneurysms and aortic dissection [12] and cardiovascular disease [13,14].

Recently, more and more attention has been paid on the predictive value of a sIAD for clinical outcome. The meta-analysis reported by Clark et al. [15] showed that a sIAD of ≥15, but not ≥10 mm Hg was associated with increased all-cause and cardiovascular mortality. However, at that time for Clark's analysis, only three cohort studies involving the association between a sIAD of ≥10 or ≥15 mm Hg and mortality could be used. In the last three years, seven cohort studies [13,14,16–20] on this topic were published. Thus, it is possible for us to perform an updated meta-analysis to identify the predictive value of a sIAD, especially of a sIAD of ≥10 mm Hg, for all-cause and cardiovascular mortality in community- and patient-based cohorts, as well as to compare the predictive value of a sIAD on sequential with that on simultaneous BP measurements.

2. Methods

2.1. Search strategy

We followed the standard criteria for conducting meta-analysis of observational studies and reporting the results [21]. We systematically searched databases, including Medline/PubMed (from 1966) and Embase (from 1980) before 15th August 2014. We used the following

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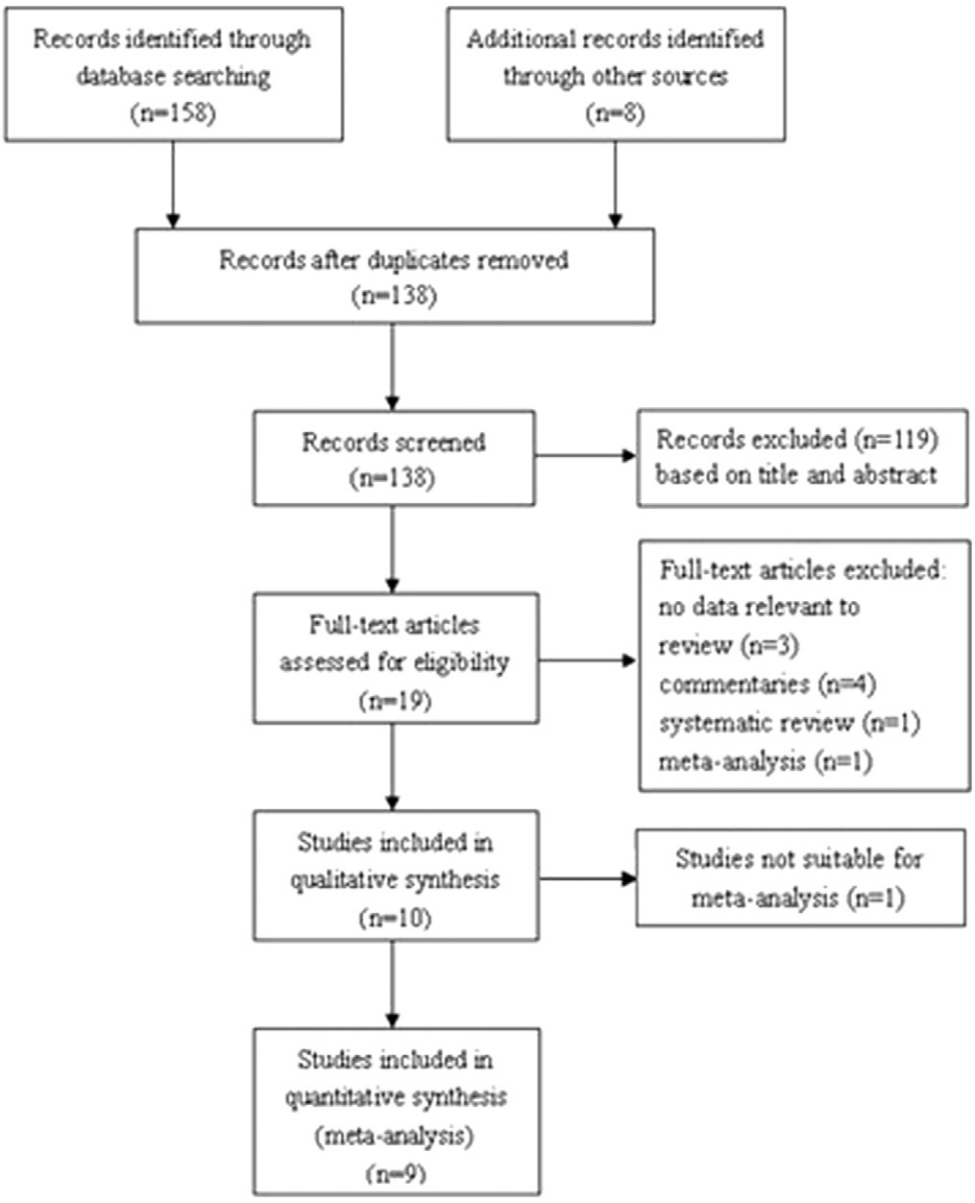

Fig. 1. Study selection.

search terms for PubMed: ("inter arm blood pressure difference" or "inter arm difference in blood pressure" or "blood pressure difference between arms" or "difference in blood pressure between arms" or "four limb blood pressure" or "subclavian stenosis") and ("mortality" or "prognosis" or "implication" or "survival"). Similar search terms were used for Embase. A manual search of reference lists of appropriate review articles and of the original retrieved studies was also performed to identify studies potentially missed by the database searches. No restrictions were imposed on language of publications.

2.2. Study selection

We excluded letters, comments, reviews and meta-analyses. Studies were included only if (1) they were a prospective or retrospective cohort study; (2) compared a sIAD of ≥10 mm Hg versus a sIAD of ≤10 mm Hg and/or a sIAD of ≥15 mm Hg versus a sIAD of ≤15 mm Hg; and (3) reported all-cause mortality and/or cardiovascular mortality with or without other outcomes. To identify eligible studies, two independent investigators (KWC and JSX) conducted an initial screening of all titles or abstracts and then evaluated all potentially relevant articles based on full text reviews. Additionally, the studies that did not report clear data on outcomes in terms hazard ratio were excluded. If the study populations were reported more than once, the result with the longest follow-up time was used.

2.3. Data extraction and quality assessment

Data extraction was conducted with a standardized data collection form. Two authors (KWC and JSX) independently extracted the following data from the included studies: first author, publication year, country, type of study, participants, sample size, mean age, sex, prevalence of hypertension and diabetes, duration of follow-up, outcomes, method of BP measurement, cut-off value of a sIAD, ascertainment of outcomes, and covariates adjusted in the multivariable analysis.

Quality assessment was performed independently by two authors (KWC and JSX) according to the Newcastle–Ottawa scale [22], with disagreements resolved by consensus with the other author (QS). The system has three components assessing studies on selection of