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Ambulatory blood pressure and risk of heart failure: a mini-review

FRANCESCA COCCINA^{1,2,*}, ROSA SCURTI², ORIANA TRUBIANI¹, SANTE D. PIERDOMENICO¹

¹ Department of Innovative Technologies in Medicine & Dentistry, University "Gabriele d'Annunzio", Chieti-Pescara, Chieti, Italy

² UOC Geriatria, Ospedale Civile Santo Spirito, Pescara, Italy

*Corresponding author. E-mail: f.coccina@gmail.com

Abstract. The aim of this mini-review is to report current knowledge about the association between ambulatory blood pressure and risk of heart failure in hypertension. We conducted a literature search through PubMed, Web of science and Cochrane Library by using terms such as ambulatory blood pressure, 24-hour blood pressure, daytime blood pressure, nighttime blood pressure, hypertension, heart failure. We identified 4 studies including 7891 patients who developed 260 cases of heart failure during the follow-up. The evaluation of published studies indicates that ambulatory blood pressure is superior to clinic blood pressure in predicting the occurrence of heart failure. Particularly, it has been reported that 24-hour blood pressure values, nighttime non-dipping blood pressure pattern and ambulatory resistant hypertension are associated with increased risk of heart failure above clinic blood pressure. Nevertheless, there are still few data in the literature on this topic. Therefore, further studies are needed to broaden our knowledge on this matter to improve our therapeutic approach to prevent HF in hypertensive patients.

Keywords: ambulatory blood pressure, hypertension, heart failure.

INTRODUCTION

A lot of studies indicate that out-of-office blood pressure (BP), detected by ambulatory BP monitoring or home BP recording, is superior to clinic BP in predicting various cardiovascular outcomes in hypertensive patients (Williams et al, Whelton et al, Pierdomenico et al, Coccina et al, Huang et al).

Heart failure (HF) is a relevant public health matter that is characterized by high mortality and costs (Roger VL). Hypertension is one of the most important causes of HF occurrence (McMurray JJ, Stewart S). Indeed, its population-attributable risk for HF has been shown to be as high as that of coronary artery disease (Dunlay et al). Nevertheless, clinic BP, as for other cardiovascular consequences, may not entirely depict the harmful effect of hypertension on HF. In this scenario, only few studies have attempted to evaluate whether ambulatory BP is superior to clinic BP in predicting HF onset.

The aim of this mini - review is to report current knowledge about the association between ambulatory BP and risk of HF in hypertension.

METHODS

We conducted a literature search through PubMed, Web of science and Cochrane Library up to June 30, 2023. The terms used to identify studies were ambulatory blood pressure, 24-hour blood pressure, daytime blood pressure, nighttime blood pressure, hypertension, heart failure. Inclusion criteria were 1) full articles published in peer-reviewed journals; 2) use of ambulatory BP monitoring; 3) data on the occurrence of HF reported as a separate outcome. We identified 4 manuscripts (Ingelsson et al, Pierdomenico et al, Kario et al, Coccina et al).

RESULTS

In a Swedish study, 951 elderly men were investigated (Ingelsson et al). Ambulatory BP monitoring was performed at baseline. Seventy men developed HF during follow-up (median 9.1 years). In multivariable Cox regression analysis adjusted for covariates, a 1-standard deviation (9 mm Hg) increase in nighttime diastolic BP (hazard ratio [HR] 1.26, 95% confidence interval [CI] 1.02-1.55) and “nondipping” (night-day BP ratio ≥ 1 ; HR 2.29, 95% CI 1.16-4.52) were associated with increased risk of HF. After adjusting for clinic BP, nondipping remained a significant predictor of HF (HR 2.21, 95% CI 1.12-4.36 vs normal night-day pattern). The authors concluded that nighttime BP conveys additional risk information on HF beyond clinic BP and other risk factors.

In an Italian study, the occurrence of HF with reduced ejection fraction (HFREF) or preserved ejection fraction (HFPEF) was evaluated in 1191 elderly treated hypertensive patients who underwent ambulatory BP monitoring to evaluate 24-hour BP, dipping status, and morning surge (MS) of BP (Pierdomenico et al). During the follow-up (mean 9.1 years), 123 patients developed HF, of whom 56 had HFREF and 67 had HFPEF. After adjustment for covariates, Cox regression analysis showed that 24-hour systolic BP, but not clinic BP, was associated with risk of both HFREF (HR 1.36, 95% CI 1.14-1.63, per 10 mm Hg increment) and HFPEF (HR 1.35, 95% CI 1.13-1.61, per 10 mm Hg increment); moreover, high MS of BP (>23 mm Hg) in dippers was associated with risk of HFREF (HR 2.27, 95% CI 1.00-5.15) and nondipping was associated with risk of HFPEF (HR 2.78, 95% CI 1.38-5.63). The authors concluded that

in elderly treated hypertensive patients, 24-hour systolic BP is associated with future risk of both HFREF and HFPEF, whereas high MS and nondipping are associated with risk of HFREF and HFPEF, respectively.

In a Japanese study, the authors investigated the effect of resistant hypertension, diagnosed by ambulatory BP monitoring, on the risk of HF (Kario et al). Globally, 5839 patients were studied. According to clinic BP, ambulatory BP and number of drugs used, patients were classified in those with true resistant hypertension, pseudo resistant hypertension, well-controlled nonresistant hypertension or uncontrolled nonresistant hypertension. During a mean follow-up of 4.5 years, 67 HF events occurred. The adjusted risk of HF was increased in patients with true resistant versus controlled nonresistant hypertension (HR 2.24, 95% CI 1.17-4.30) and versus uncontrolled nonresistant hypertension (HR 3.03, 95% CI 1.58-5.83). The authors concluded that true resistant hypertension diagnosed by ambulatory BP monitoring is a significant independent risk factor for HF.

In another Italian study, the risk of HF was assessed in elderly treated hypertensive patients with white coat uncontrolled hypertension (WUCH), ambulatory nonresistant hypertension (ANRH) and ambulatory resistant hypertension (ARH), compared to those with controlled hypertension (CH) (Coccina et al). Globally, 745 treated hypertensive subjects older than 65 years were investigated, of whom 153 had CH, 153 had WUCH, 307 had ANRH and 132 (18%) had ARH. During a mean follow-up of 8.4 years, 82 HF events occurred. After adjustment for covariates, when compared to CH, the HR (95% CI), for HF was 1.30 (0.51-3.32), 2.14 (1.03-4.43) and 3.52 (1.56-7.96) in WUCH, ANRH and ARH, respectively. The authors concluded that, among elderly treated hypertensive patients, those with ARH are at a considerably higher risk of HF when compared to CH.

DISCUSSION

Hypertension is one of the most frequent chronic diseases and is responsible for various cardiovascular complications. Among these, HF is an increasingly relevant problem in individuals with long-lasting hypertension and in elderly patients. However, clinic BP, as for other cardiovascular outcomes, may not completely describe the detrimental effect of hypertension on the occurrence of HF. Indeed, 24-hour ambulatory BP has repeatedly been shown to be a powerful predictor of future combined cardiovascular events, even after adjustment for clinic BP. In this context, some studies have also tried to evaluate whether ambulatory BP might

be superior to clinic BP in predicting HF. The literature analysis indicate that ambulatory BP is superior to clinic BP in predicting the occurrence of HF. Particularly, it has been reported that 24-hour BP, nondipping and ambulatory resistant hypertension are associated with increased risk of HF above clinic BP, emphasizing that traditional clinic BP does not capture all the increased risk of HF associated with hypertension. However, there are still few data in the literature on this topic. Therefore, further studies are needed to broaden our knowledge on this matter to improve our therapeutic approach to prevent HF in hypertension.

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