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EDITORIAL COMMENT

Pulse wave velocity, central aortic pressure, and arterial reflection waves in white coat hypertension☆

A velocidade de onda de pulso, pressão aórtica central e ondas refletidas retrógradas na hipertensão da bata branca

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White coat hypertension (WCH) is defined as office blood pressure (BP) of >140/90 mmHg but otherwise normal BP in untreated individuals.[1–6] BP is assessed ideally by ambulatory BP monitoring (ABPM), by self-measurement on at least three occasions, and more than once by office measurement. WCH, first described by Pickering in the 1980s,[7] should not be confused with the white coat effect or alerting reaction,[8] a rise in BP in the presence of a physician that occurs in normotensives as well as hypertensives, irrespective of whether they are under antihypertensive therapy.[9]

For many authors, the alerting reaction and WCH are expressions of the same pathophysiological phenomenon.[10–12] They are distinguished in two ways. Firstly, the mechanism behind the alerting reaction may not be the same as that underlying WCH, as pointed out by Pickering, who suggested that the alerting reaction may be an adaptive physiological response by the sympathetic nervous system.[9] Secondly, WCH is only found in untreated individuals.

In their study published in this issue of the *Journal*, Almeida et al.[13] restrict the diagnosis of WCH to untreated individuals. The requirement for subjects to be untreated removes some of the confusion surrounding the interpretation of study results by excluding individuals defined as having ''false-resistant hypertension in treated patients'' in the European guidelines,[1,2] who in some studies are classified as having WCH.[14–18]

In pathophysiological terms, it is likely that in normotensive individuals who present high BP only when visiting their physician or at other times of stress (white coat hypertensives) the intrinsic mechanisms that regulate BP will be different from those in hypertensives, even those whose hypertension is controlled by medication and who have high BP in the physician's office. The patient's history of hypertension and comorbidities also need to be taken into account.

The cross-sectional study by Almeida et al. is the first to compare normotensives, white coat hypertensives and hypertensives, matched for age, gender and body mass index (BMI), in terms of pulse wave velocity, aortic stiffness index and data on central pressures including arterial wave reflections. It is also the first study to extend the diagnostic criteria for WCH to nocturnal BP, previous works having considered only daytime BP on ABPM.[11,12] It further specified that hypertensives should have been under antihypertensive therapy for at least six months and should have their BP controlled according to ABPM.

Including nocturnal BP in the definition of WCH increases diagnostic rigor by covering the period with greatest prognostic significance for cardiovascular events[19] and effectively excluding individuals who may have elevated

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BP only at night (isolated nocturnal hypertension). Furthermore, careful matching for age, gender and BMI reduces the bias inherent in interpreting results from groups that differ significantly in these respects.[11,20–23]

However, it would have improved the analysis if information had been provided on the severity and history of hypertension in the hypertensive group and on comorbidities including diabetes, dyslipidemia and smoking in all three groups, since these factors can influence arterial distensibility.[11,24,25]

In their discussion, the authors highlight the controversy in the literature concerning the prognostic value of WCH. The conflicting results reported are at least partly due to the inclusion of white coat hypertensives and false-resistant hypertensives in the same sample.[12,26,27] However, having removed this source of confusion, Almeida et al. clearly showed that indices of arterial stiffness, central pressures and wave reflection in white coat hypertensives do not differ significantly from normotensives and are lower than in hypertensives. Similar results were found when white coat hypertensives were divided into two subgroups according to systolic BP on ABPM (<120 mmHg and 120-129 mmHg), indicating that WCH may be a relatively benign condition compared to hypertension.

The pulsatile components of the aortic pressure wave are in fact important predictors of cardiovascular events.[28–30] Wimmer et al.[23] compared central aortic BP assessed by applanation tonometry in normotensives and white coat hypertensives, the latter having higher central aortic pressures, suggesting increased cardiovascular risk in WCH. It should, however, be noted that the white coat hypertensives were an average of 10 years older than the normotensives in this study.

In a longitudinal study with a 15-year follow-up, Sung et al.[11] compared pre-hypertension, WCH and sustained hypertension, but once again the white coat hypertensives were 10 years older than the hypertensives. They highlighted two points: arterial aging is one of the main determinants of WCH; and the severity of WCH may depend on the magnitude of wave reflections. With regard to the first point, in a cohort study in two cities in northern Portugal, Cunha et al.[25] found high mean pulse wave velocities using normal European reference values as comparators, particularly in younger individuals, reflecting early arterial aging associated with more severe comorbidities. Concerning the second point, increased arterial wave reflections have been associated with the presence of target organ damage and increased cardiovascular mortality, unlike the relatively normal wave reflection data in WCH. Analysis of Kaplan-Meier event-free survival curves clearly reveals a sharp difference between weak and strong arterial wave reflections. According to the authors, assessment of wave reflections can thus predict cardiovascular prognosis in WCH.

Almeida et al. found a relatively benign profile of aortic stiffness and central pressures in white coat hypertensives compared to hypertensives, suggesting weaker wave reflections. This cross-sectional study is the first to compare white coat hypertensives, hypertensives and normotensives in which the diagnostic criteria for WCH and hypertension included nocturnal BP values, which have the greatest cardiovascular prognostic value.

Further longitudinal studies with greater statistical power are needed to confirm whether WCH is as benign as suggested in this study.

Conflicts of interest

The author has no conflicts of interest to declare.

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