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Cardiovascular risk in white coat hypertension: An evaluation of the ankle brachial index

Dayana Freitas, MSN, Adrielle Naiara Toneti, BSN, Evandro José Cesarino, PhD, Vagner Luis Desidério, MD, Sérgio de Figueiredo Pacca, MD, Simone de Godoy, PhD, Isabel Amélia Costa Mendes, PhD, and Leila Maria Marchi-Alves, PhD

The aim in this study was to identify the cardiovascular risk in patients suffering from white coat hypertension (WCH) by determining the ankle brachial index (ABI) with an automatic oscillometric sphygmomanometer. The study was undertaken in a Brazilian city between August 2010 and June 2011. The study variables were age, ethnic origin, marital status, education level, profession, weight, height, waist circumference, arm and ankle blood pressure (BP), and ABI. Analysis of variance was used for repeated measures and Tukey's test for multiple comparisons of means. The linear relationship between systolic BP levels and ankle brachial indices was verified using Pearson's correlation coefficient. Results were expressed as mean values ± standard errors of means, and differences were considered statistically significant when $P < .05$. *Study participants were 135 subjects, including 37% normotensive, 37% hypertensive (HT), and 26% WCH patients. WCH individuals revealed intermediate risk in the analysis of the clinical variables. Alterations compatible with peripheral obstructive arterial disease and arterial calcification were observed only in the HT and WCH groups. These findings lead to the premise that WCH should not be viewed as a benign condition. The measurement of the ABI should be considered in the clinical approach of patients and professionals should use it as an instrument for cardiovascular risk assessment in routine health care delivery.* (J Vasc Nurs 2014;32:38-45)

Systemic arterial hypertension (SAH) is a chronic disease with high prevalence levels worldwide. Hypertension cannot be considered as a single condition, but should be recognized as part of a conglomerate of morbid outcomes. It is associated with the coexistence of several clinical manifestations and multiple events and cardiovascular complications. It particularly affects patients' health and quality of life and strongly affects morbidity and mortality rates in all countries.[1,2]

Recent data indicate that the prevalence rate of the disease in the American population ranges around 29%. The presence of secondary complications or injuries to target organs owing to hypertension increases the risks of the hypertensive (HT) population, with a mortality rate about 10 times higher than in the general population.[3]

Scientific evidence supports the idea that SAH is a major risk factor for the development of cardiovascular complications, but the contribution of white coat hypertension (WCH) in the pathogenesis of arterial diseases also deserves attention.

From the University of São Paulo at Ribeirão Preto College of Nursing, São Paulo, Brazil; Sermed Saúde SA, São Paulo, Brazil.

Corresponding author: Dayana Freitas, MSN, University of São Paulo at Ribeirão Preto College of Nursing, Av. dos Bandeirantes, 3900, Bairro Monte Alegre, 14.040-902 RibeirãoPreto, São Paulo, Brazil, 3271 (E-mail: dayana_df@hotmail.com).

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WCH is characterized as a persistent increase in blood pressure (BP) levels in the doctor's office or clinic and normal BP levels in other circumstances.[4] For a precise diagnosis of WCH, the detection of BP levels using the casual measure only is insufficient. A complementary investigation is needed.[5]

Outpatient BP monitoring (OBPM) is the specific method indicated to diagnose WCH and consists in indirect BP measurement using a properly validated device, at preset intervals over a 24-hour period, while the patient is performing routine activities. The criterion used for this diagnosis is a BP ≥ 140/90 mmHg during the first clinical visit, which remains high after the second and third visits, with normal behavior outside the clinic (BP < 130/85 mmHg), when assessed using OBPM.[6]

The physiopathology of the BP increase in WCH has been widely discussed. Electrocardiographic and metabolic findings show that patients with WCH present left ventricular hypertrophy, hardening of the inner layer of the arteries, and diabetes mellitus, among other comorbidities, with high risk for the development of essential hypertension and coronary diseases, beside high mortality rates owing to cardiovascular disease.[6–12]

WCH is known as a pathologic event with many particularities, and it is the responsibility of investigators and health professionals to carefully address the phenomenon and associated conditions, in view of continuing controversy and ambiguity regarding its meaning, prognosis, and therapeutics.[13,14] Among the questions that remain, the possibility of vascular alterations associated with WCH deserves more careful study.

Other authors have observed secondary complications of hypertension WCH and SAH patients have in common, such as an increase in the intima media thickness of the vessels, compliance, arterial rigidity, and elasticity compared with normotensive (NT) individuals.[15,16] Arterial rigidity and inflammation also constitute secondary clinical complications of BP alterations, which can lead to cardiovascular events in HT patients. A recent study showed that patients with WCH presented a high degree of arterial rigidity and increased levels of inflammation in intermediate levels among NT and HT individuals.[17]

The ankle brachial index (ABI) is used to detect peripheral obstructive arterial disease and cardiovascular disease and has attracted considerable clinical and scientific interest. The ABI is a noninvasive method used in clinical practice to detect cardiovascular diseases, such as arterial failure, peripheral arterial disease (PAD) and atherosclerosis, and also permits the prognosis of cardiovascular events and mortality.[18–20]

Initially, this method, described by Carter,[21] was only determined with the use of vascular Doppler. More recently, studies have demonstrated the efficacy of using automatic oscillometric sphygmomanometers (AOS) for the determination of this index, because it is simpler, low cost, and easy to use,[22] permitting its adoption in routine health service practice. The use of AOS to determine the ABI is a safe and practical alternative compared with the conventional Doppler method to determine PAD.[22–25] The applicability of AOS to determine the ABI is clear and researchers found an 88% sensitivity and 85% specificity level to diagnose PAD, determining that the precision and efficacy of the oscillometric method are similar to the vascular Doppler method.[26]

In comparison with individuals with normal ABI, individuals with altered indices are at an approximately 4 times greater risk of developing cardiovascular diseases. The earlier this condition is detected, the greater the chances of reducing mortality rates owing to complications deriving from arterial diseases like stroke, left ventricular hypertrophy, and hypertension.[27] Other studies discussing the importance of determining the ABI through AOS have indicated that between 50% and 75% of patients with altered ABI are asymptomatic.[28,29] It has also been reported that 25% of patients submitted to ABI evaluation during nursing consultations in primary health care were diagnosed with PAD, showing the importance of measuring this index in nursing practice, especially in actions aimed at preventing chronic conditions, in which the general cardiovascular risk tends to be moderate or severe.[30]

Based on the important relationship among cardiovascular diseases, ABI, and SAH, it is presupposed that WCH can also cause modifications in ABI parameters; this analogy has never been studied, however. The question is raised whether the ABI, used as a prognostic marker of cardiovascular events, would classify WCH patients into a higher degree of risk when compared with subjects who are NT or are at similar risk to that observed in HT patients. The purpose of this study was to identify the cardiovascular risk in WCH individuals through the determination of the ABI by means of AOS.

METHODS

This descriptive, cross-sectional study was developed in a Brazilian city. The study sample included patients from a preventive health care unit, who were divided into 3 groups (NT, HT, and WCH individuals).

A non-probabilistic convenience sample was used. The participants were invited to participate in the study when they visited the unit for care between August 2010 and June 2011. Exclusion criteria applied to individuals <18 years of age, women who were pregnant or had recently given birth, those with contraindications for ankle BP measurement (painful inflammatory processes, wounds, phlebitis, or extreme edema), diabetes mellitus, presence of cardiac arrhythmia evidenced by health examinations with an expert's report presented to the author or described in the medical record and use of anticoagulant, and/or platelet inhibitors that could influence ABI results. Comorbidities were self-reported and verified through the evaluation of health tests presented to the researcher or through the description of the disease process in a clinical history.

Sociodemographic data were collected during an interview, which was conducted in a private room at the health care unit at times previously scheduled by the author or when the participant visited the unit for care. Anthropometric data were evaluated in accordance with the recommendations of the Brazilian Association for the Study of Obesity and Metabolic Syndrome.[31] Measurements included weight, height, body mass index (BMI), and waist circumference (WC).

In the calculation of the BMI, weight and height were considered, obtained through the following equation: BMI = weight (kg)/height $(m)^2$ and categorized according to the following cutoff points: <18.5 kg/m^2 (low weight), 18.5-24.9 kg/m^2 (eutrophic), 25.0-29.9 kg/m^2 (overweight), 30.0-34.9 kg/m^2 (level I obesity), 35.0-39.9 kg/m^2 (level II obesity), and ≥40.0 kg/m^2 (level III obesity).[31]

WC was obtained at the smallest curve between the lower rib and the iliac crest, using a flexible, non-elastic metric tape with a 0.1 cm precision level, without compressing the tissue. When the smallest curve could not be identified, the WC was measured 2 cm above the umbilical scar. Based on the parameters of the Brazilian Obesity Guidelines (2009)[31] for WC measures, individuals were classified in 3 groups: No risk (women WC < 80 cm and men WC < 94 cm), increased risk (women WC ≥ 80 and <88 cm and men WC ≥ 94 and <102 cm) and substantially increased risk (women ≥ 88 cm and men ≥ 102 cm).

To measure BP through the indirect and oscillometric method, OMRON HEM 705 CP equipment was used, with cuff size appropriate to the patient's arm circumference. All technical requirements for appropriate BP measurement complied with Brazilian arterial hypertension guidelines.[32]

MAPA was used to sort the subjects into the appropriate groups. This procedure was performed in accordance with national guidelines for the use of OBPM,[6] utilizing Spacelabs/model 90207 equipment. Indirect and intermittent measures were performed via the oscillometric method. Participants with BP ≤ 140/90 mmHg in the consultation room and BP ≤ 130/85 mmHg in the rest period of OBPM were considered NT; HT patients presented BP ≥ 140/90 in the consultation room and BP > 130/85 in the rest period of OBPM; and WCH patients were individuals with BP ≥ 140/90 on repeated measures in the consultation room and BP ≤ 130/85 mmHg in the rest period of OBPM.

The ABI was measured in accordance with the technique proposed by Kawamura,[22] in which BP measurements are performed on the 4 limbs during clinical examination, using 2 AOS devices (OMRON HEM 705 CP). The ABI was obtained by simultaneously measuring the systolic BP (SBP) on the brachial arteries of both arms. The arm with the highest SBP was chosen; however, when the difference between the SBP on both arms was >10 mmHg, a new measure was obtained after a 5-minute interval. If the difference continued, the use of the right arm was standardized to measure the index. Next, the SBP was simultaneously measured on the selected arm and the inferior