International Journal of Community Medicine and Public Health
Durugu S et al. Int J Community Med Public Health. 2022 Oct;9(10):3710-3714
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20222560

Original Research Article

White-coat hypertension by ambulatory blood pressure monitoring in individuals with elevated office blood pressure and correlation with co-morbidities

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Received: 24 July 2022
Accepted: 20 September 2022

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ABSTRACT

Background: White-coat hypertension characterized by elevated office blood pressure and normal ambulatory blood pressure monitor measurements has an incidence of 10-30%. It is considered that white-coat hypertension is not entirely benign condition and progression to hypertension has been identified in some cases.
Methods: 197 consecutive subjects with elevated office blood pressure measurements were evaluated by ambulatory blood pressure monitoring and assessed for co-morbidities.
Results: Of the 197 subjects evaluated 138 (70.05%) had hypertension and 59 (29.95%) had white-coat hypertension. Diabetics comprised of 21.73% of hypertensive individuals and 25.42% of white-coat hypertension individuals (p value 0.57). Similarly, when assessed for body mass index and dyslipidemia there was no statistically significant difference in both the groups.
Conclusions: White-coat hypertension is a common condition and proper assessment by ambulatory blood pressure monitoring to diagnose the condition can avoid unnecessary antihypertensive medication. Identification of other co-morbidities could lead to appropriate management goals.

Keywords: White-coat hypertension, Ambulatory blood pressure monitoring, Body mass index, Diabetes mellitus, Dyslipidemia

INTRODUCTION

White coat hypertension is not an uncommon condition with an incidence between 10% to 30% of subjects attending clinics due to elevated blood pressure.[1] White coat hypertension is characterized by elevated office blood pressure recording and a normal home blood pressure recording or normal ambulatory blood pressure recording.[2] Although white-coat hypertension was considered to be associated with relatively low cardiovascular risk compared with established hypertension, various cross-sectional and prospective studies have shown contradictory results with some suggestive of an increased cardiovascular risk and others low risk.[3-8] Helvaci et al have observed an increased predisposition for white-coat hypertension in the presence of other cardiovascular risk factors such as obesity, diabetes mellitus and dyslipidemia.[9] White-coat hypertension can be identified by frequent home blood pressure monitoring. However, ambulatory blood pressure monitoring has the advantage of having measurements in real-life conditions, assessment of nocturnal blood pressure, short term variability and has a stronger prognostic significance.[10] Current guidelines suggest life-style modifications for management of individuals with white-coat hypertension when the total

cardiovascular risk is low and are without hypertension mediated organ damage.[1] They need regular follow-up as they may develop sustained hypertension requiring medication.[10-13] Ohasama study suggested that white-coat hypertension was a risk factor for developing home hypertension over 10-years follow up.[14] In a study by Verdicchia et al 28% of 64 subjects with white-coat hypertension developed systolic hypertension after an average follow up of 2.7 years.[15] The objective of the present study was to assess the incidence of white-coat hypertension in individuals with elevated office blood pressure by ambulatory blood pressure monitoring and assess for correlation with gender and other cardiovascular risk factors of obesity, diabetes and dyslipidemia.

METHODS

The study was performed as a retrospective analysis at the department of cardiology at an out-patient care center in the United Arab Emirates. Consecutive individuals between April 2019 and December 2020, referred for cardiac assessment due to elevated office blood pressure were included in the study. Three serial office blood pressure measurements recorded over 4 weeks intervals of equal to or over 140 mm Hg systolic and/or 90 mm Hg diastolic were considered as hypertensive range of blood pressure.[1] Individuals with established hypertension, who were on antihypertensive medication with inadequate blood pressure control were excluded from the study. Detailed history of co-morbid conditions and clinical history was obtained from all the subjects and resting blood pressure was measured in both upper limbs in a comfortable sitting posture for 10 minutes by a standardized digital apparatus. 3 serial recordings were obtained at 2-minute intervals and mean blood pressure was considered as the individual's office blood pressure measurement. All the subjects' height in centimeters and weight in kilograms were recorded and body mass index was calculated. Blood samples were obtained for evaluation of fasting glucose and fasting lipid profile and renal function tests. All the subjects underwent standard 12 lead electrocardiogram and echocardiography in M-mode, 2-dimensional and colour Doppler assessment. Sokolov-Lyon's criteria were used to calculate for left ventricular hypertrophy on the electrocardiogram. Interventricular septal and left ventricular posterior wall measurements were obtained in standard M-mode images to assess for left ventricular hypertrophy by echocardiography. All the subjects underwent 24-hour ambulatory blood pressure monitoring using TRISMED ambulatory blood pressure monitor (TRISMED CO., LTD). The average 24-hour blood pressure, average daytime blood pressure and average night time systolic and diastolic blood pressure recordings were considered for assessment of hypertension. An average 24-hour blood pressure of ≥130 and/or ≥80 mmHg, daytime average blood pressure of ≥135 and/or ≥85 mm Hg and night time average blood pressure of ≥120 and/or ≥70 mm Hg were considered as hypertensive. All the individuals with ambulatory blood pressure measurements of less than the above-mentioned values were considered to be having white-coat hypertension. Statistical analysis was performed with SPSS statistical software using Chi-square and paired T-test to assess for statistical significance.

RESULTS

During the period of the study, 326 subjects underwent 24-hour ambulatory blood pressure monitoring. Among them, 129 individuals were excluded from the study as they had established hypertension on regular antihypertensive medication and were inadequately controlled with high office blood pressure measurements. 197 subjects were included in the study to be assessed by ambulatory blood pressure monitor to establish hypertension or white coat hypertension. Males comprised of 145 and females 52. Baseline characteristics of the subjects were shown in (Table 1).

Table 1: Baseline characteristics (n=197).

Parameters	Observations
Gender (male/female)	145/52
Age (mean±SD)	43.52±9.08
Body mass index in Kg/Sq M (Mean±SD)	27.79±5.15
Office systolic blood pressure (Mean±SD)	151.54±14.82
Office diastolic blood pressure (Mean±SD)	96.83±9.78
Diabetes mellitus N (%)	45 (22.8)

The mean body mass index was in overweight range of 27.79 Kg/Sq meter. Diabetics comprised of 22.8% of the studied individuals. Following evaluation by 24-hour ambulatory blood pressure measurements, 138 individuals were identified to have hypertension and 59 individuals with white-coat hypertension according to guideline-based criteria (Table 2).[1] Subjects with hypertension comprised of 70.05% and white-coat hypertension 29.95% (Figure 1).

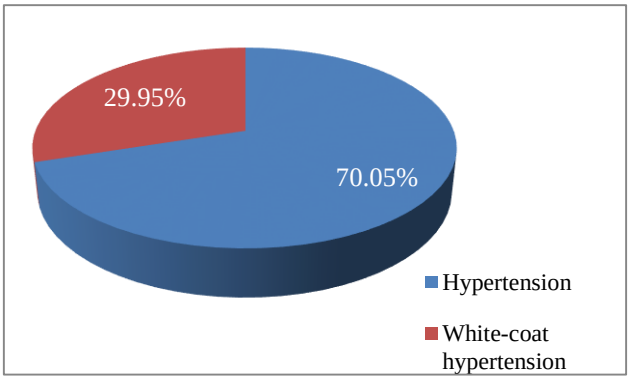

Figure 1: Gender distribution of hypertension and white-coat hypertension.

Table 2: Ambulatory blood pressure measurement (n=197).

Parameters	Hypertension (N=138)	White-coat hypertension (N=59)	Significance (p<0.05)
Age (Mean±SD)	43.44±8.96	43.72±9.42	0.24
Male N (%)	98 (71%)	47 (79%)	0.24
Female N (%)	40 (29%)	12 (21%)	0.24
BMI (Mean±SD)	27.83±5.10	27.70±5.32	0.28
Office SBP (Mean±SD)	152.21±15.63	149.96±12.70	0.33
Office DBP (Mean±SD)	97.27±10.03	95.79±9.14	0.34
Diabetes N (%)	30 (21.73%)	15 (25.42%)	0.57
LDL cholesterol (Mean±SD)	120.00±34.03	116.32±32.29	0.48
24 hour ABPM Systolic (Mean±SD)	141.17±12.19	120.37±7.60	<0.0001
24 hour ABPM Diastolic (Mean±SD)	89.56±9.42	74.98±6.17	<0.0001
Day time ABPM Systolic (Mean±SD)	143.63±12.53	122.65±8.00	<0.0001
Day time ABPM Diastolic (Mean±SD)	91.28±9.84	77.14±6.49	<0.0001
Night time ABPM Systolic (mean±SD)	129.28±21.31	108.04±8.73	<0.0001
Night time ABPM Diastolic (Mean±SD)	81.36±9.54	65.87±7.24	<0.0001

Diabetics comprised of 22.8% of all the subjects evaluated. 14 individuals in the hypertension group comprising of 10.14% were diagnosed based on elevated nocturnal blood pressure measurement with normal day time as well as 24-hour average blood pressure measurements.

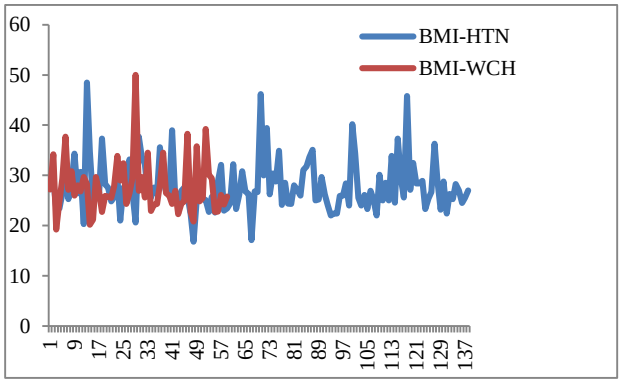

Figure 2: Body mass index in hypertension and white-coat hypertension.

There was no significant statistical difference in the baseline parameters of subjects with hypertension and white-coat hypertension with similar gender distribution. When assessed for other co-morbidities there was no statistically significant difference in both groups (Table 2). Mean body mass index (BMI) was 27.83±5.10 and 27.70±5.32 in subjects with hypertension and white-coat hypertension respectively which was not statistically significant (p=0.28) (Figure 2).

Diabetics comprised of 25.42% in white-coat hypertensive subjects in comparison to 21.73% in hypertensive (p=0.57) (Figure 3). The mean(±SD) LDL cholesterol was 116.32±32.29 in white-coat hypertensive group compared to 120.00±34.03 in hypertensive (p=0.48) (Figure 4).

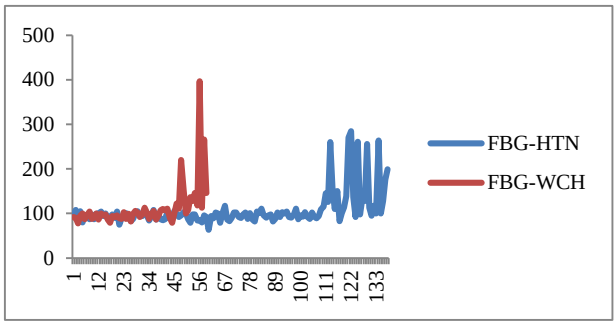

Figure 3: Fasting blood glucose (mg/dl) in hypertension and white-coat hypertension.

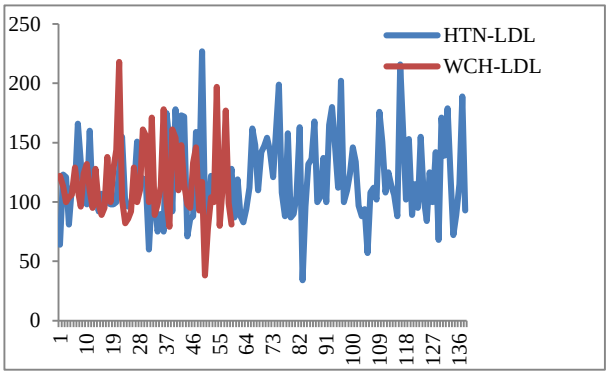

Figure 4: LDL cholesterol (mg/dl) in hypertension and white-coat hypertension.

DISCUSSION

White-coat hypertension is not uncommon and has been observed with a prevalence of 15 to 50 percent among all patients presenting with elevated office blood pressure in various studies.[1,16]. Diagnosing white-coat hypertension can avoid unnecessary antihypertensive medication. However, white-coat hypertension is not entirely a benign condition. During the 8-year follow-up in the Ohasama

study, 46.9% of subjects with white-coat hypertension developed sustained hypertension compared to 22.2% in normotensive individuals with an odds ratio of 2.86.[17] The National institute of health and care excellence (NICE) guidelines recommend that all individuals with office blood pressure measurements between 140/90 mmHg and 180/120 mmHg need to be evaluated by ambulatory blood pressure monitoring to confirm the diagnosis of hypertension.[18] The present study has observed the incidence of white-coat hypertension to be nearly a third of all the individuals who presented with elevated office blood pressure measurements, thus avoiding antihypertensive medication. The study also observed that 10% of subjects diagnosed with hypertension needing treatment were diagnosed based on an elevated nocturnal blood pressure measurement with normal daytime and 24-hour average blood pressure. These individuals would otherwise have been labelled as white-coat hypertension if only home blood pressure monitoring was considered during the initial assessment, asserting the importance of ambulatory blood pressure monitoring in the evaluation to diagnose hypertension due to high variability of blood pressure. In a large meta-analysis of 17312 hypertensive individuals, it was observed that reduced nocturnal dipping of blood pressure was associated with 27% higher risk of cardiovascular events compared to normal nocturnal dipping.[19] Studies have demonstrated that bedtime antihypertensive medication can restore nocturnal dipping of blood pressure and can provide cardiovascular protection.[20,21] Compared to Home blood pressure monitoring , ambulatory blood pressure monitoring gives the additional advantage of identifying the population with elevated night time blood pressure and nocturnal non dippers.[10] The present study has not demonstrated a significant association of co-morbid conditions like diabetes mellitus, body weight and hyperlipidemia among both the groups of hypertension and white-coat hypertension. However, earlier studies showed a higher prevalence of white-coat hypertension with increase in body mass index.[9] One study has demonstrated a higher prevalence of dyslipidemia in white-coat hypertension when compared to individuals with hypertension.[22] Presence of metabolic syndrome can adversely affect individuals with white-coat hypertension with increased left ventricular mass and hence requires appropriate monitoring.[23]

CONCLUSION

White-coat hypertension is a common condition in individuals presenting with elevated office blood pressure measurements. Appropriate assessment to identify the condition is necessary to avoid unnecessary antihypertensive medication. Although repeated home blood pressure measurements are a convenient method for diagnosing hypertension, ambulatory blood pressure monitoring provides more accurate evaluation for diagnosing white-coat hypertension. Additionally, it could also identify a subset of patients of hypertension presenting with only nocturnal hypertension as well as individuals with hypertension who have a reduced nocturnal dip who are at higher cardiovascular risk. Presence of white-coat hypertension with other co-morbidities can have an enhanced cardiovascular risk and could identify the subset of people who need more vigorous monitoring and potential treatment.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Durugu S, Rao S. White-coat hypertension by ambulatory blood pressure monitoring in individuals with elevated office blood pressure and correlation with co-morbidities. Int J Community Med Public Health 2022;9:3710-4.