Evaluation Of Echocardiographic Parameters in Patients with White Coat and Masked Hypertension Detected by Ambulatory Blood Pressure Monitoring

Nadia H. Sahib[(1)], Shahlaa Kh. Chabuk [(2)], Amjed H. Abbas [(3)], Ali Salih Beey [(4)], Samir Sawadi Hammoud [(5)]

[(1)]Ph.D. Medical Physics, Hammurabi College of Medicine, University of Babylon . [(2)]Ph.D. Medical Physiology, Hammurabi College of Medicine, University of Babylon. [(3)]Ph.D. Medical Physiology, Hammurabi College of Medicine, University of Babylon. [(4)] MRCP. ,Medical, Hammurabi College of Medicine, University of Babylon. [(5)] Ph.D. Medical Physiology, College of Medicine, University of Babylon.

Abstract

Background: The usual clinical measurements of blood pressure provide poor correlation to determine cardiac changes, the data obtained from 24 hours ambulatory blood pressure monitoring (ABPM) provides more benefit than the usual measurements.

Aim of the study: The aim of this study was to assess the echocardiographic changes in patients who have masked hypertension (MH) and white coat hypertension (WCH) depending on monitoring of blood pressure by ambulatory method.

Method: This study was conducted on 66 subjects in a private clinic in Al-Hilla city; the subjects underwent a 24hs ABPM in addition to a transthoracic echocardiography. Based on the readings of ABP measurements, average and maximum 24h diastolic and systolic blood pressure (BP) were analyzed during mean nighttime (from 10 p.m. to 6 a.m.) and during mean daytime (from 6 a.m. to 10 p.m.). The echocardiographic parameters included the measurement of left atrial size, left atrial diameter (LAD), posterior cardiac wall thickness (PWT), anterior cardiac wall thickness (AWT), E/A ratio, left ventricular end-diastolic diameter (LVEDD), and isovolumic relaxation time (IVRT).

Result: The percentage of patients having WCH was higher than MH 41:66 (62%) vs. (38%) (25:66). Regarding WCH, there were few patients had personal history of hypertension 5 (12%) and most of them had family history of hypertension 36 (88%), while in case of MH, all patients had negative personal history of hypertension and most of them had negative family history 21 (84%) of hypertension. This study also showed a significant relation between EA ratio and type of hypertension (p=0.000) and the ratio was increased more in MH than WCH, also it showed significant relation between types of hypertension and all calculated echocardiographic parameters and the changes in MH were more than those in WCH.

Conclusion: The study showed a considerable relation between type of hypertension and all calculated echocardiographic parameter, the risk on the heart is more in MH than WCH. ABPMs is clinically more useful than traditional blood pressure measurements.

Key words: Echocardiographic parameters, ABPMs, white coat hypertension, masked hypertension.

Introduction

Ambulatory blood pressure monitoring (ABPM) was described for the first time since 40 years (1). The ambulatory monitoring tools record blood pressure automatically for 24 hs duration or more while patients perform the daily activities normally (2). Oscillometric techniques are used in most monitors. They are tied on a belt and are connected by a plastic tube to the sphygmomanometer cuff on the upper arm (3). The arm of subjects should remain still during inflation of the cuff in addition to avoiding severe physical activities during monitoring (4). The monitor program takes readings every quarter to half hour during the night and the day, the readings then are downloaded into a computer at the end of the recording period (5,6). White coat hypertension (WCH) can be defined as the clinic blood pressure of 140/90 mm Hg or more on at least three visits, with measurements of less than 140/90 mm Hg at least two occasions in non-clinic settings with no target-organ damage (7). The importance of this diagnosis comes from general acceptance that WCH patients have low risk and weekly benefit from antihypertensive drugs (8). Some WCH patients may develop sustained hypertension, with increased risk of stroke after six years, so the continuous follow-up with ABPM is important (9). Masked hypertension (MH) is defined as a clinic blood pressure less than 140/90 mm Hg at least three visits and more than 140/90 mm Hg at least two occasions in non-clinic settings by ABPMs (10). The risk of cardiovascular complications of patients with MH are underestimate during the clinic blood pressure measurements (11). This study is aimed to assess the echocardiographic parameters in patients with WCH and MH as determined by ABPMs.

Patients and methods

This is a cross-sectional study was done in a private clinic in the period from November 2018 to May 2019, it included 66 subjects with no history of hypertension, chronic heart diseases, diabetes mellitus or other chronic diseases. Demographic data were taken from each subject that included age, gender, personal and family history of hypertension, and the type of hypertension whether MH or WCH, body mass index (BMI) was measured by the dividing the weight (in kg) to height (in square meters). The 24 hours ABPM was

performed during day and night at home, during working days, when the subjects performing their usual activities. It was performed by Medset system (Korea) according to current guidelines. The program of the device was as the following: the readings of BP was obtained at 20-minute intervals during the day (starting from 6 a.m. to 10 p.m.) with 30-minute intervals during the night (starting from 11 PM to 7 AM), the readings of recordings were then analyzed to give us a 24-hour, nighttime and daytime average diastolic BP (DBP), systolic BP (SBP), and cardiac rate which then downloaded to a personal computer (PC) to be processed with specialized software to obtain the values of nighttime and daytime average diastolic BP (DBP) and systolic BP (SBP). The echocardiographic parameters were done by using a commercially available ultrasound system (Philips ,USA, Clearvue 350 with harmonic probe S 4-1). Left atrial diameter (LAD), LA size, left ventricular end-diastolic diameter (LVED, posterior wall thickness (PWT), anterior wall thickness (AWT), EA ratio and iso-volumic relaxation time (IVRT) were measured by M-mode, a transthoracic echocardiogram were done for all study subjects.

Statistical Analysis: The statistical analysis for all results in this study was performed by using the SPSS version18. Some continuous variables expressed as number and percentage while others variables were expressed as mean ± standard deviation (SD) by using descriptive and frequency analysis. Cross-tabulation and T-test was used to analyze some categorical and continuous data. The level of p values < 0.05 was regarded a statistically significant.

Results

This study enrolled 66 patients, (41 males and 25 females) and the mean age was 44.48±11.147**.**

1. Distribution of hypertension types: The percentage of WCH was higher than MH, 41:66 (62%) vs. 25:66 (38%), as showed in figure(1).

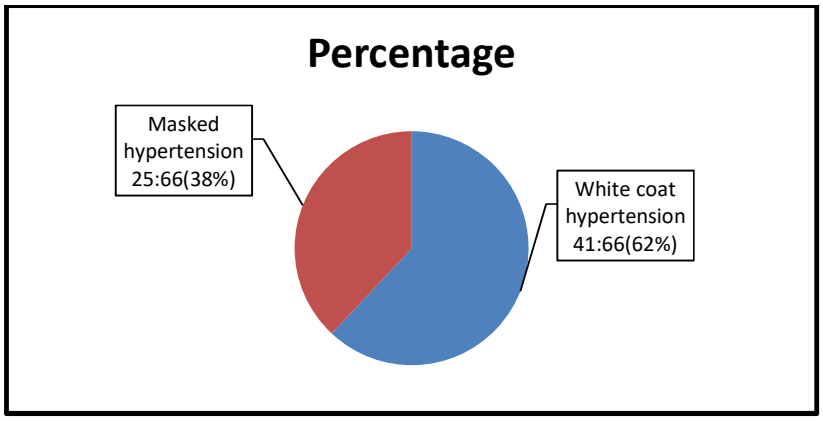

Figure (1): Distribution of white coat hypertension and masked hypertension.

2. Relation between gender and types of hypertension: There was no significant relation between gender and types of hypertension as illustrated in table (1).

Table (1): Relation between gender and types of hypertension.

Types of hypertension	Gender No.(%)		P value
	Males (No.41)	Females (No.25)	
White coat hypertension	27 (66%)	14 (56%)	0.2
Masked hypertension	14 (34%)	11 (44%)	

3. Distribution of hypertension types according to personal and family history of hypertension: Regarding WCH, There were few patients had personal history of hypertension and most of them had family history of hypertension while in case of MH, all patients had negative personal history of hypertension and most of them had negative family history of hypertension as illustrated in table (2) and table (3).

Table (2): Relation between personal history and types of hypertension.

Types of hypertension	Personal history of hypertension No.(%)		Total	P value
	positive	Negative		
White coat hypertension	5 (12%)	36 (88%)	41(100%)	0.001
Mask hypertension	0 (0%)	25 (100%)	25(100%)	0.000

Table (3): Relation between family history and type of hypertension.

Types of hypertension	Family history of hypertension No.(%)		Total	P value
	Positive	Negative		
White coat hypertension	36 (88%)	5 (12%)	41 (100%)	0.001
Mask hypertension	4 (16%)	21 (84%)	25(100%)	0.001

4. Relation between EA ratio and type of hypertension: Table (4) shows significant relation between EA ratio and type of hypertension (p=0.000) and the ratio was increased more in MH than WCH.

Table (4): Relation between EA ratio and type of hypertension

Diagnosis	**EA No.(%)**					**Total**
	0.6	0.7	0.8	0.9	1.0	
White coat hypertension	2 (5%)	26 (63%)	6 (15%)	3 (7%)	4 (10%)	41 (100%)
Masked hypertension	0 (0%)	0 (0%)	0 (0%)	0 (0%)	25 (100%)	25 (100%)
Total	2 (3%)	26 (40%)	6 (9%)	3 (4%)	29 (44%)	66 (100%)
P value	0.000					

5. Relation between masked and white coat hypertension with echocardiographic parameters: There was significant relation between types of hypertension and all calculated echocardiographic parameters, the changes in MH were more than those in WCH as illustrated in table (5).

Table (5): Relation between MH and WCH and echocardiographic parameters

Parameter	Mean ±SD		P value
	Masked hypertension No= 41	White coat hypertension No.=25	
Awt	11±2.03	8.8±0.95	0.000
Pwt	8.93±1.42	7.4±0.96	0.000
EA ratio	0.75±0.10	1±0.00	0.000
LAD	24.10±3.5	20.48±1.5	0.000
IVRT	112.68±32.7	75.80±11.33	0.000
LVEDD	45.88±4.7	42.32±2.07	0.001

Pwt = posterior wall thickness, Awt= anterior wall thickness, EA= early (E) to late (A) ventricular filling velocities, LAD= left anterior diameter, IVRT= Iso-volumic relaxation time, LVEDD= left ventricular end-diastolic diameter.

6. Relation between masked and white coat hypertension with ambulatory blood pressure readings: There was significant relation between types of hypertension with average and maximum ambulatory measurements of blood pressure during daytime and night as shown in table (6), the readings were higher in MH patients than patients with WCH.

Table (6): Relation between MH and WCH with ABPM.

Ambulatory blood pressure readings	**Masked hypertension No=41**	**White coat hypertension No.=25**	**P values**
	Mean ± SD	**Mean ± SD**	
ASBP at daytime	126.37±10.51	113.08±10.045	0.000
ADBP at daytime	75.12±7.82	69.76±9.666	0.01
ASBP at night	125.83±8.85	116.08±14.384	0.001
ADBP at night	74.20±8.3	69.92±13.46	0.1
MSBP at daytime	169.41±24.83	150.64±21.93	0.003
MDBP at daytime	106.66±24.93	103.68±25.406	0.6
MSBP at night	149.76±18.64	143.20±23.372	0.2
MDBP at night	92.12±12.53	95.64±17.15	0.3

ASBP= average systolic blood pressure, ADBP= average diastolic blood pressure, MSBP= maximum systolic blood pressure, MDBP= maximum diastolic blood pressure

Discussion:

In this study, we provided the new insight to cardiac mechanical dysfunction in WCH and masked hypertensive patients. The highly increased risk of occurrence of cardiovascular events lies behind the clinical importance of MH and WCH (12) . Our study reassured the unfavorable effect of WCH and MH on left ventricular function and structure. The percentage of patients with WCH was larger than MH patients (62% versus 38). There are many mechanisms that illustrate the effect of WCH on cardiac remodeling. One of them is that the humoral mechanisms that include increased stimulation and interactions of the renin-angiotensin-aldosterone system and sympathetic system which can lead to pulmonary vascular hyper-reactivity (13,14). There are no definitive cause and mechanisms for MH, some studies revealed that there is correlation between MH and young age, male gender and smoking (15, 16).Our study showed that subjects who had MH have larger target organ damage than WCH, and this agrees with some longitudinal studies like one of them that revealed patients with MH had more cardiovascular morbidity (17,18,19). In addition to a study performed by Ohasama which revealed that the cardiovascular mortality risk was larger for patients with MH and sustained hypertension than for those patients with established normal blood pressure and WCH patients (20). The explanation for this finding might be related to the fact that patients with masked hypertension remain for long duration without diagnosis and treatment (21, 22, 23).

Conclusion:

This study showed the impairment of LV mechanical function in white coat hypertension and masked hypertension and the effect of MH was greater than WCH in addition to the great benefit of using ambulatory blood pressure monitoring to evaluate those patients which is clinically more superior than traditional blood pressure measurements.

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