Original Article

COMPARISON BETWEEN THE BLOOD PRESSURE READINGS TAKEN BY AMBULATORY BLOOD PRESSURE MONITORING DEVICES WITH BLOOD PRESSURE TAKEN AT HOME

Ahmed Ali[a], Qazi Abdul Saboor[b], Faqir Mohammad Awan[b], Qazi Muhammed Tufail[b] , Amber Malik[b], Arz Muhammad[b], Husnain Bashir[b], Muhammad Abdul Rehmaan[b]

[a]Department of Cardiology, Punjab Institute of Cardiology, Lahore - Pakistan.
[b]Shaikh Zayed Postgraduate Medical Institute, Lahore - Pakistan.
* Corresponding author: drsaboor04@gmail.com

Submission Date: 22-10-2019
Revision Date: 05-11-2019
Publication Date: 20-03-2020

Author's Contribution

AA: Conducted study QAS: Helped in conduction of study ,wrote, audit and reviewed the article as a whole. FMA:Figures. QMT: Helped in Re-arranged data and corrected article. AM: consultants incharge of the audit and gave frequent advice, corrections and did the proof reading also. AM: Tables and figures and also Helped in analysis of data. HB: Tables. MAR: Helped in analysis of data and typing.

All authors declare no conflict of interest.

This article may be cited as: Ali A, Saboor QA, Awan FM, Tufail QM, Malik A, Muhammad A, Bashir H, Rehman MA. Comparison between the blood pressure readings taken by ambulatory blood pressure monitoring devices with blood pressure taken at home . J Cardiovasc Dis 2020;16(1):28 - 32

ABSTRACT :

Hypertension is one of the important predisposing factor for coronary artery disease and other cardiovascular pathologies. This study was perfomed to find the mean difference in systolic and diastolic blood pressure readings taken at home and by ambulatory blood pressure monitoring devices(HBPM and ABPM) in known hypertensive patients.

MATERIAL AND METHODS:The cross sectional survey was carried out in the division of Medicine, Shaikh Zayed Medical College, Lahore from 08-01-2016 to 08-07-2016.One hundred and thirty patients were enrolled through outpatients department of Medicine, Shaikh Zayed Medical College, Lahore. All patients were applied with ABPM device for one day and print outs of the readings were obtained. The device was adjusted to obtain blood pressure (BP) at every 15 minute intervals from hour 0800 to 2200 and then 30 minute interval for the rest of the day. The patients were given HBPM device for next one week. The patients recorded their BPreadings between hours 0800–2200.

RESULTS: Males were 53.08%(n=69) while there were 46.92%(n=61) females. The mean age was 45.35±8.55 years. Mean systolic pressure was calculated as 147.7±5.59 in HBPM and 143.16±5.57 in ABPM while mean diastolic pressure was 108.08±6.40 in HBPM and 105.5±6.49 in ABPM. There was a mean difference of 4.54±0.02 for systolic and 2.58±0.09 for diastolic pressures in two of the chosen methods for blood pressure recordings. p-value was calculated as 0.0001 for systolic and 0.0014 for diastolic pressure.

CONCLUSION: The mean difference in systolic and diastolic blood pressures taken by HBPM and ABPM devices in known hypertensive patients is statistically significant. This method may be an easy and cost effective technique which is helpful for monitoring of blood pressure.

KEYWORDS: Hypertension, home blood pressure monitoring, ambulatory blood pressure monitoring.

(J Cardiovasc Dis 2020;16(1):28 - 32)

INTRODUCTION

Hypertension falls in the list of most common diseases that are prevalent worldwide. It is an important predisposing factor for cerebrovascular system or renal system.[1] According to the American Heart Association (AHA), hypertension(HTN) is labeled if the systolic blood pressure (SBP) is more than 140 mm Hg and diastolic blood pressure (DBP)more than 90 mm Hg and if the patient is on antihypertensive drugs.[2] In 1990 to 1994, The National Health Survey was conducted in Pakistan, which highlighted the disease burden of HTN . This survey showed that prevalence of HTN in adults older than 15 years was 18% while it numbered to 33% of adults >45 years . Among hypertensive patients , about 70% were unaware of their disease.[3]

The monitoring of BP is particularly required for management of hypertension. There are different methods of monitoring of blood pressure. Ambulatory blood pressure monitoring (ABPM) is getting popularity for the monitoring of blood pressure clinically.[4] This is especially helpful if the patients are having discrepancies in BP readings in different situations especially when there is wide difference of BP in home and clinicians office . Blood pressure readings during night may also provide prognostic data that can also effect the management regimens.[5,6]

Home blood pressure monitoring (HBPM) is other way to moniter BP .It is defined as measurement of out of office BP by patient himself or by a trained person in a standardized way. This is different from self-blood pressure measurement (SBPM), which is non-systematized measurement of BP according to doctor's guidance or patient's decision[7] , in which patient himself or herself takes the blood pressure readings at anytime at home. This also provides the monitoring of BP and is simple, cost effective and easy to use.[7,8]

Previously, a study by Hond ED, et al,[9] showed that there was a difference between the mean diastolic and systolic blood pressure readings of ABPM and HBPM. In a study of 247 patients, it has been noticed that mean diastolic and systolic blood pressures with HBPM was 91.5±9.0 mm of Hg and 143.1±16.1 mm of Hg respectively. With ABPM, the mean systolic blood pressure was 148.1±14.2 mm of Hg and mean diastolic blood pressure was 88.6±8.6 mm of Hg. Thus a difference was found between the pressure reading taken with these techniques (difference in systolic blood pressure readings was 5.0±2.1 mm of Hg and diastolic blood pressure was 2.9±0.4 mm of Hg).

In clinical situitations with blood pressure reading discrepencies, it has been seen that ABPM is under used. So, this study was perfomed to find the mean difference in systolic and diastolic blood pressure readings taken by home and ambulatory blood pressure monitoring devices(HBPM and ABPM) in known hypertensive patients.

MATERIAL AND METHODS:

This cross-sectional observational study was conducted at, Shaikh Zayed Medical College, Lahore over a period of six months. Sample size of 130 cases is calculated with 95% of confidence level, d=0.07 and taking expected mean ± S.D of mean difference in diastolic blood pressure i.e. 2.9±0.4mm Hg taken with home blood pressure monitoring device and ambulatory blood pressure in known hypertensive patients. Non probability consecutive sampling was used.

Inclusion criteria was ages between 20 years to 60 years of either gender and all patients with hypertension (defined as systolic blood pressure more than 140 mmHg and diastolic blood pressure more than 90 mmHg) for at least a period of six months. Those patients who refused to get themselves enrolled in the study and the patients who could not use HBPM due to physical or mental disability were excluded.

BP readings were taken by ABPM device after every 15 minute intervals from 0800-2200 and then 30 minutes interval for rest of the day. Readings were also taken in the same way but by using HBPM device. Then mean difference was calculated by subtracting the average HBPM value from ABPM value.

One hundred and thirty patients fulfilling the inclusion criteria were enrolled through outpatients department. Consent was taken. General data including age and gender was collected. All the patients were educated about the use of both ABPM and HBPM devices by a doctor. All patients were applied with ABPM device for one day and print out of the readings was obtained. The following protocols were applied:

ABPM protocol: The device was adjusted to obtain blood pressure at every 15 minute intervals from hour 0800 to 2200 and then 30 minute interval for the rest of the day.8 HBPM protocol: The patients were given HBPM device for next one week. The patients recorded their blood pressure readings between hours 0800–2200. Each measurement session consisted of three readings at 1 minute intervals while sitting at a desk or table.[8]

The two readings which were closed to each other were taken as correct. After discarding the first day's readings, other 24 readings were averaged to give us the average HBPM day time reading for the subject. The mean difference is calculated by subtracting the average reading of ABPM from HBPM reading (as per operational definition).

The collected data was transferred to SPSS version 16. The qualitative variable included: gender (male or female), was presented as frequency and percentages. The quantitative variables analyzed including age, HBPM and ABPM difference and height, weight, BMI, systolic and diastolic blood pressures of the two devices were described as mean with standard deviation. The data was stratified for age, gender, obesity (BMI >30 or <30 kg/m2). Student t-test was used after startification. Less than or equal to 0.05 p value was considered significant.

RESULTS:

The data of 130 cases was analysed. The age distribution was ; 30.77%(n=40) were among 20-40 years of age while 69.23%(n=90) were lying in the range of 41-60 years. Mean ± SD of age in years was calculated as 45.35±8.55 . (Table No. 1)

Gender distribution showed that males were 53.08%(n=69) while there were 46.92%(n=61) females. Body mass indices of patients were calculated in Table No. 3, where means of weight, height and BMI were 72.00±11.84kgs, 5.43±0.28(meter) and 26.21±3.49 respectively. (Table No. 2,3).

Mean SBP of patients was calculated as 147.7±5.59 in HBPM and 143.16±5.57 in ABPM while mean DBP was 108.08±6.40 in HBPM and 105.5±6.49 in ABPM , mean difference was 4.54±0.02 for systolic and 2.58±0.09 for diastolic pressure between two methods. The calculated p value for systolic blood pressure was 0.0001 and for diastolic blood pressure it was 0.0014 . (Table No. 4).

Data stratification was done for variables like age, gender, obesity (BMI >30 or <30 kg/m^2). Student t-test was applied after stratification . Less than or equal to 0.05 p value was significant. (Table No. 5-7).

Table-1: Distribution of age

Age (years)	Number of patients(n=130)	Percentages
20-40	40	30.77
41-60	90	69.23
Total	**130**	**100**
Mean±SD	**45.35±8.55**	

Table-2: Gender distribution

Gender	Number of patients(n=130)	Percentages
Males	69	53. 08
Females	61	46. 92
Total	**130**	**100**

Table-3: Body mass index of the patients

Variables	Mean	SD
Weight (kg)	72.00	11.84
Height (m)	5.43	0.28
BMI	**26.21**	**3.49**

Table-4: Mean blood pressure of the patients

Type of blood pressure monitoring	Systolic		Diastolic	
	Mean	SD	Mean	SD
HBPM	147.7	5.59	108.08	6.40
ABPM	143.16	5.57	105.5	6.49
Mean difference	**4.54**	**0.02**	**2.58**	**0.09**
P value	**0.0001**		**0.0014**	

Table-5: Startification for mean blood pressure of the patients with respect to age

20-40 years	Systolic		Diastolic	
	Mean	SD	Mean	SD
HBPM	147.90	7.04	107.90	7.04
ABPM	143.23	6.79	105.33	7.01
Mean difference	**4.67**	**0.25**	**2.57**	**0.03**
P value	**0.003**		**0.10**	

41-60 years	Systolic		Diastolic	
	Mean	SD	Mean	SD
HBPM	147.61	4.86	108.16	6.14
ABPM	143.13	4.98	105.58	6.28
Mean difference	**4.48**	**0.12**	**2.58**	**0.14**
P value	**0.0001**		**0.005**	

Table-6: Startification for mean blood pressure of the patients with respect to gender

MALE	Systolic		Diastolic	
	Mean	SD	Mean	SD
HBPM	147.49	5.94	107.57	5.90
ABPM	142.91	5.88	104.96	6.01
Mean difference	**4.58**	**0.06**	**2.61**	**0.11**
P value	**0.0001**		**0.011**	

FEMALE	Systolic		Diastolic	
	Mean	SD	Mean	SD
HBPM	147.93	5.22	108.66	6.93
ABPM	143.44	5.25	106.11	6.99
Mean difference	**4.49**	**0.03**	**2.55**	**0.06**
P value	**0.0001**		**0.046**	

Table-7: Startification for mean blood pressure of the patients with respect to BMI

Less than 30	Systolic		Diastolic	
	Mean	SD	Mean	SD
HBPM	147.80	5.83	108.20	6.72
ABPM	143.30	5.78	105.65	6.80
Mean difference	**4.5**	**0.05**	**2.55**	**0.08**
P value	**0.0001**		**0.004**	

More than 30	Systolic		Diastolic	
	Mean	SD	Mean	SD
HBPM	147.06	3.70	107.24	3.60
ABPM	142.53	4.09	104.53	3.84
Mean difference	**4.53**	**0.39**	**2.71**	**0.24**
P value	**0.001**		**0.041**	

DISCUSSION:

Hypertension is one of common modifiable risk factor for coronary artery disease and may be a cause of morbidity and mortality all over the world. Diagnosis of HTN is made by several clinic or office BP measurements. ABPM is more reliable and accurate for the estimation of mean blood pressure as multiple readings are recorded at different times and different settings. However, HBPM may also provide useful information about damage of target organs.

This research was carried out to see the usefulness of the both techniques used for monitoring of blood pressure. In this study, there was a significant p value for systolic and diastolic pressures in both methods i.e. mean difference was 4.54±0.02 for systolic and 2.58±0.09 for diastolic blood pressure in two methods; p value was calculated as 0.0001 for systolic and 0.0014 for diastolic blood pressure.

The results of this study are comparable with a previous study by Hond ED, et al,[9] showing that there was a difference between the mean diastolic and systolic blood pressure readings of ABPM and HBPM. In another study of 247 patients, mean systolic and diastolic blood pressures with HBPM was 143.1±16.1 mm of Hg and 91.5±9.0 mm of Hg respectively . With ABPM, the mean SBP was 148.1±14.2 mm of Hg and mean DBP was 88.6±8.6 mm of Hg. Thus a difference was found between the systolic and diastolic blood pressure reading between the techniques (difference in systolic blood pressure readings was 5.0±2.1 mm of Hg and diastolic blood pressure was 2.9±0.4 mm of Hg). Our findings are consistent with the previous studies.

According to several studies , HBPM shows better correlation with cardiovascular outcomes and end organ damage as compared to BP measurements in clinic.[10-12] HBPM has many advantages over ABPM. It is cost effective , easy to use ,widely available and also renders good compliance to treatment and BP control.[13] However, it cannot be used for BP assessments during sleep and during job hours thereby , blood pressure variability cannot be assessed. It carries a drawback to induce anxiety in some patients due to repetitive recording of BP. A meta-analysis done recently has reported that 24-hour ABPM is a better single test to diagnose HTN in adults compared to home or measurements taken in clinics in terms of sensitivity and specificity.[14] It is prudent to use HBPM in conjunction with ambulatory monitoring as a harmonizing method of BP recording. HBPM may prove to be a suitable technique for long lasting follow up in hypertensive patients especially when there is concordance between different techniques .

A Markov model was developed by Lovibond et al[15] to analyse the cost-effectiveness of three diagnostic methods for hypertension after a high blood pressure reading in initial clinic evaluation . It was shown that ABPM was the most cost-effective method for the diagnosis and management of hypertension among of all age groups. It is cost effective and cost saving for better management of hypertension and reduces the anxiety as well. However, HBPM is useful for those who cannot afford ABPM.

Though, the results of our study demonstrate a significant difference between HBPM and ABPM but the difference is not very higher and 4mm Hg may be accepted and advised for patients as an easy and cost/ time effective technique which is helpful for controlling of blood pressure.

CONCLUSION:

The mean difference in systolic and diastolic blood pressures taken by HBPM and ABPM devices in known hypertensive patients is statistically significant but this small difference may be acceptable. This method may be an easy and cost effective technique which is helpful for monitoring of blood pressure.

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