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A COMPARATIVE STUDY OF LEFT VENTRICULAR GEOMETRY, AMONG HYPERTENSIVE PATIENT CLASSIFIED AS DIPPERS AND NON DIPPERS.

Cardiology

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ABSTRACT

Objective: A blunted nocturnal fall in BP(Non dipping)pattern increases cardiovascular risk and leads to target organ damage. Among hypertensive patients ambulatory blood pressure monitoring can able to detect various nocturnal blood pressure pattern. Hypertensive patient with abnormal left ventricular geometry and left ventricular function found to be blunted nocturnal fall in BP(Nondipping)pattern on ambulatory BP monitoring.

Method: A group of dippers and non dippers formed consisting 50 patients in each group according to nocturnal BP pattern. More than 10% decrease in mean SBP than day time mean SBP was defined as dippers . ECHO parameter taken to calculate ,Left ventricular mass and LV geomertry and compared among both group.

Results: Nondipping pattern was significantly associated with abnormal ECHO parameters of LV geometry and LV diastolic function. Enlarged left atrium , left ventricular wall thickness, LV mass and mass index were significantly associated with blunted nocturnal BP response. These patients also have more prevalent concentric left ventricular hypertrophy.

KEYWORDS

ambulatory blood pressure, left ventricular geometry, non dipping.

INTRODUCTION

Hypertension remains the most common disease entity leading to morbidity and mortality in patients with hypertension [1]. The range of cardiac geometric adaptation to persistent elevated blood pressure include from cardiac remodelling to significant, concentric and eccentric hypertrophy.[2]

Patient with persistent HTN without treatment have higher incidence myocardial infarction ,stroke, peripheral arterial diseases , aortic dissection and cognitive decline. Chronic over burden to left ventricular afterload causes compensatory left ventricular free wall hypertrophy and these adaptational changes associated with increase in the incidence of cardiovascular disease. There are four type of LV geometry described according to free wall , septal thickness and its relation with LV cavity. Out of them the concentric type of left ventricular hypertrophy has been associated strongly with cardiovascular risk [3,4].

A decrease nocturnal fall in BP have strong genetic association as well as affected by environmental factors [7], and it is associated with older age, cognitive dysfunction, diabetes, obesity, race, sleep apnea, impaired endothelium dependent vasodilatation, elevated levels of markers of inflammation, left ventricular hypertrophy (LVH), impaired renal function, and mortality from cardiovascular disease [4,8–10]. These blunted response known as -Non dipping pattern, reverse dipping and nocturnal hypertension, these all pattern reflects disturbances in the mechanisms regulating BP, and its presence is considered as an indicator of advanced stage of organ damage compared with dipping pattern [11].

In current era Ambulatory blood pressure (BP) monitoring is found to be better related with target organ damage. As mentioned nocturnal hypertension and blunted night time BP response have been shown to have more frequent increase in left ventricular mass (LVM) and abnormal geometric adaptation in left ventricle among all hypertensive patients and better corelated with ABP value than conventional office BP measurements [11].

Not only associated risk and target organ damage but response to treatment and improved cardiovascular prognosis may be more closely correlated with reductions in ambulatory BP than office blood pressure [12-15]. Day-time and night-time blood pressure values and their changes due to treatment are related to each other [16], but the prognostic value of night-time blood pressure has been found superior [17,18, 19]. Blunted response of nocturnal BP associated with significant cardiac remodelling and LV diastolic dysfunction (LVDD) and may result in a cardiovascular risk independent of the increase in LVM in both hypertensive patients and in normotensives[20].

However, there are conflicting data regarding the relationship between the circadian rhythm of BP, especially non-dipping nocturnal BP, and LVH and left ventricular diastolic function in patients with essential hypertension.

We hypothesized that patients with the non-dipper pattern would have a more pronounced left ventricular hypertrophy than patients with the dipper pattern. Accordingly, we evaluated and compared structural echocardiographic parameters in hypertensive patients known to have dipper and non-dipper characteristics during 24-h BP monitoring.

MATERIAL AND METHOD

Aim and objective

To compare echocardiographic parameters between hypertensive patients defined as dippers and non-dippers during ambulatory blood pressure (BP) monitoring.

To determine difference in LV geometry among both group.

Sample size : Sample size is required minimum 50 cases in each group at 95% confidence and 80 %power to verify the expected difference of 22.3% in the proportion of cases with concentric remodeling among dippers(42.3%) and non dippers(20%) ,the sample size is adequate to cover other primary variables of study.

Study population: We considered a group of 100 consecutive subjects with new diagnosis(< 1 YEAR) of grades 1 and 2 hypertension according to WHO Guidelines.

Exclusion criteria: Significant kidney disease, Diabetes mellitus, valvular heart disease, heart failure and history of ischaemic heart disease h/o copd ,asthma ,chronic lung disorder, patient with atrial arrhythmias ,SBP Value >180 mm of Hg, DPB value > 110 mm Hg.

Study type : It was a Single Centre observational study conducted in Department of Cardiology, SMS Hospital Jaipur from period of april. 2016 to Dec. 2017.

All essential hypertensive patients aged between 30 to 60 years were subjected to routine and other relevant investigation.

After complete detailed history and physical examination regarding search for secondary causes. 24-hour ambulatory BP monitoring done. After that patients subjected to echocardiography examination , all parameters taken and recorded . Blood samples obtained for all patients .

Biochemical and Hematological parameters , FBS, RBS, Lipid profile, Serum creatinine, Hb, Compete blood counts, TSH, USG abdomen,urine R/M.

According to nocturnal blood pressure responce Hypertensive subjects were divided into 2 groups, dippers and non-dippers. Nocturnal fall of

blood pressure of more than 10%, measured as mean arterial pressure (MAP) and nocturnal fall of mean blood pressure of less than 10% defined as dippers. 2D Echocardiogram to assess LV systolic and diastolic function LV geometry and these parameters compared between both groups.

Transthoracic Echo

Transthoracic echo examination was performed in our department with measurements of chamber dimensions taken from two-dimensional M-mode and calculation of LV mass. Linear measurements were made according to the guideline of European Society of Echocardiography [21

Ambulatory BP Monitoring

ABPM was performed with the patient wearing a portable BP measuring device, on the non-dominant arm or the arm with the highest blood pressure, for continuous 24 hours period so that it gives information on BP during daily activities and at night during sleep[23]. All readings and measurements done according guidelines.[24]

Statistical analyses

All statistical analyses were performed using SPSS version 20 software. Categorical data were compared using chi-square tests. Student t test were used to compare numerical variables, respectively. Data were expressed as mean (standard deviation; SD), minimum-maximum and percent (%) where appropriate. $p < 0.05$ was considered statistically significant

Results

Demographic and clinical characteristics of the study population are reported in Table I with no significant differences between the studied groups. Dippers and non-dippers did not show significant differences as regards anthropometric variables as well as in risk factors and characteristics of hypertensive status

Table 1. demographic, anthropometric, clinical and metabolic variables in dippers and non dippers

Variables	Dippers	Non Dippers	P Value
Mean age,years	54.10±10.5	52.5±5.8	0.12
Sex	16M,34F	18M,32F	0.22
BMI,kg/m²	24.2±3.2	25.9±3.5	0.54
BSA , m²	171.78±26	172.5±18.8	0.23
F/H of HTN in 1st degree relative %	55	49	0.09
WHO Grade 1 HTN, %	70	61	0.078
WHO Grade 2 HTN, %	30	39	0.11
Duration of HTN , Months	11±0.85	10.7±0.5	0.43
Smoking History , %	59	68	0.07
B.sugar ,mg/dl	90±12.5	94±11	0.11
LDL cholesterol, mg/dl	133.07±26.5	127.8±8.9	0.21
HDL cholesterol,mg/dl	51.15±13.4	50.37±11.7	0.23
Trigliceride,mg/dl	79.05±7.04	80.6±7.4	0.17
Serum uric acid,mg/dl	4.10±0.75	4.35±0.68	0.21

By definition, non-dippers showed higher average systolic and diastolic pressure during the night, although 24-hour blood pressure was similar between the groups (Table II).

No significant differences in clinical and 24- hour ambulatory SBP, MBP, and DBP values were found between dippers and non-dippers. (Table II). Differences between dippers and non-dippers were not affected by the sex of patients (the interaction sex/dipping status was never significant in the ANOVA test)

Table 2. Clinical and ambulatory blood pressure and heart rate values in dippers vs non dippers.

Parameter	Dippers (n=50)	Nondippers (n=50)	P value
SBP, mm Hg	153.09±12.8	155.22±14.7	0.22
MBP, mm Hg	115.68±5.98	113.81±7.67	0.21
DBP, mm Hg	95±5.87	93.05±5.09	0.32
24h SBP mm Hg	134.44±7.45	135.33±14.86	0.29
24h MBP , mm Hg	103.13±6.38	103.66±10.88	0.55
24h DBP , mm Hg	88.88±9.09	85.98±8.07	0.10
Daytime SBP , mm Hg	148.78±9.21	149.87±7.76	0.42
Daytime MBP , mm Hg	108.67±6.77	106.34±10,54	0.24
Daytime DBP , mm Hg	88.12±6.12	84.23±9.76	0.23
Nighttime SBP, mm Hg	124.43±6.30	141.34±15.71	<0.01
Nighttime MBP , mm Hg	88.98±5.77	99.61±10.54	<0.01
Nighttime DBP , mm Hg	73.56±6.23	79.90±9.36	<0.05
Heart rate ,beats/minutes	75.45±6.32	71.87±7.65	0.22

Between dippers and non-dippers as regards ejection fraction, relative wall thickness, LV end-diastolic diameter, LV end-systolic diameter, interventricular wall thickness, or posterior wall thickness ,no statistically significant differences were found (Table 4).Although absolute value for end-diastolic diameter, end-systolic diameter, interventricular wall thickness, or posterior wall thickness were more in non-dipper group. Statistically significant differences were found between dippers and non-dippers as regards to left atrial dimension, LVM and LVMI.

Table 3. Echocardiographic parameters in dippers and non-dippers.

Parameters	Dippers (group A) (n=50)	Nondippers (group B) (n=50)	Value of p A vs.B
LVIDd,mm	47±4	49±5	0.17
LVIDs,mm	31±4	35±3	0.08
IVSd,mm	12±2	13±2	0.15
IVSs,mm	15±2	16±2	0.16
PWTd,mm	11±2	12±2	0.09
PWTs,mm	15±2	16±2	0.16
LVM, gm	244±64	298±62	<0.03
LVMI, g/m²	122±28	142±31	<0.03
LA mm	41±5	44±6	<0.02
EF	58±4	56±3	0.74
E/A	1.0±0.3	0.8±0.3	0.06

Table 4. Comparison of left ventricular geometric patterns between dipper and non-dipper groups ($\chi 2$ test was used for comparison of proportions)

Group	Normal LV geometry, %	Concentric remodeling, %	Concentric hypertrophy, %	Eccentric hypertrophy %
Dipper (n=50)	12(24%)	13(26%)	11(22%)	14(28%)
Non-dipper(n=50)	4(8%)	10(20%)	22(44%)*	14(28%)

*p value <0.005

DISCUSSION

Left ventricular hypertrophy is a strong predictor of cardiovascular morbidity and mortality in the general population, and particularly in patients with hypertension.

Hypertensive subjects whose night-time blood pressure does not drop suffer more severe target organ damage. In our study, as parallel to previous studies left atrial dimension and the left ventricular mass index was higher in the non-dipper hypertensive patients as compared with dipper hypertensive patients.

In our study echocardiographic measurements,61 of the 100 patients (61%) were found to have LVH (left ventricular mass index LVMI > 125 g/m2 in men and >110 g/m2 in women). LVH was concentric in 33 patients and eccentric in the remaining 28 patients .Total number of patients having LVH were 25 (50%) patients in Dipper group and 36(72%%) in non-dipper group. This was statistically significant.

In our study dippers and non-dippers both showed concentric hypertrophy more frequently among other type of LV geometry. Non-dipper group have significantly higher presence of concentric LVH than dipper group(44% v/s 22% p value <0.03) .It suggesting non-dipping pattern as an indicator of advanced stage of organ damage compared with dipping pattern. These finding are comparable with previous studies. [6]

The main finding of our study is increased prevalence of concentric LVH in the night-time non-dipper group. It has also been suggested

that non-dipping could be responsible for the development of left ventricular hypertrophy.

In agreement with our results, Felicio *et al.* [29] suggest that higher nocturnal systolic BP (NSBP) levels might be responsible for an increased prevalence of LVH in hypertensive patients with type 2 diabetes. However, in another study which enrolled diabetic patients, echocardiographic structural alterations correlated more strongly with systolic BP means than with non-dipper/dipper BP ratio [28].

n addition, the findings of Cuspidi *et al.* [27] and Stenehjem *et al.* [28] suggest that the contribution of a blunted reduction in nocturnal BP to enlarged LV mass is significant and may play a pivotal role in the development of LVH, during the early phase of essential hypertension. Moreover, subjects in whom the nocturnal decrease in blood pressure is blunted (non-dippers) have been reported to have a greater prevalence of organ damage and a less favourable outcome. A blunted fall in nocturnal BP also reflects the high level of cardiovascular risk in these patients. Nevertheless, in some studies the prognostic value of this phenomenon was lost when multivariate analysis included 24-h average blood pressure [3, 11, 12].

The relationship between BMI and non-dipping was analysed. Cuspidi *et al.* [30] suggested that hypertensive patients with overweight had a reduced nocturnal BP fall and greater cardiac organ damage as compared with their lean counterparts, despite a similar overall BP load. In their study the prevalence of dipper pattern was 15% lower in the overweight group as a whole, with a 17% difference in men and 13% in women. The prevalence of left ventricular hypertrophy was higher in patients with overweight, too.. In our study mean body mass index was similar between dipper and non-dipper groups (24.2 ±5.4 vs. 25.9 ±4.6). Despite the similar mean value, in the non-dipper group there were more patients whose BMI was above the reference values, with 37.14% obese and 42.86% overweight individuals vs. 26.92% obese and 38.46% overweight patients in the dipper group.

We also found impaired diastolic function in the hypertensive group of patients. Our data are in agreement with the study of di Bello *et al.* [31].They evaluated LV diastolic function using Doppler mitral flow velocity and PW-TDI recording at the mitral annulus level.
In the present work, the non-dipper group had a greater prevalence of concentric left ventricle hypertrophy, while concentric remodelling was non-significantly higher in the dipper group.

We have concluded that non-dipping seems to be responsible for the increased prevalence of concentric LVH in long-standing hypertension. We have suggested that the contribution of a blunted reduction in nocturnal BP to LVH is significant. It could be possible that the conversion from non-dipping to dipping pattern during treatment may play a role in the regression of myocardial hypertrophy.

It is our opinion that ABPM should be encouraged in the diagnosis and treatment of all hypertensive subjects as it gives information about the extent of night-time decrease, which could be a possible explanation for the high prevalence of LVH.

Our study included subjects with different onset, severity, and treatment modalities of hypertension. The small number of subjects may have influenced our results, such as the absence of statistical significance concerning prevalence of LV concentric remodelling in both studied groups. All study measurements were performed on patients under antihypertensive medications.

Additionally, our results are based only on 2Dmode echocardiographic technique and measurements. Although accepted for clinical investigation, this method is inferior to reference 3D echocardiographic or magnetic resonance based measurements of left ventricular mass.

CONCLUSION

To evaluate patient having hypertension, 24 hour ambulatory blood pressure monitoring is highly reliable method. This method of BP monitoring is feasible in OPD settings and secure good reliability of data if done methodically. By ABPM hypertensive patients can further stratified by dipping and nondipping pattern and can be identified as high risk group for target organ damage,as well as high cv event risk. Our study clearly shows that The concentric type of LVH is the prevalent pattern in non-dippers. Ambulatory blood pressure , which does not decrease sufficiently during night influences LV geometry. Patients with the non-dipper pattern have a more pronounced left ventricular hypertrophy . The nondipping status is associated with higher LVMI, indicating an enhanced cardiovascular risk..

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