Ambulatory blood pressure profile and left ventricular geometry in Nigerian hypertensives

O. E. Ajayi, E. A. Ajayi¹, O. A. Akintomide, R. A. Adebayo, S. A. Ogunyemi, A. T. Oyedeji², M. O. Balogun

Department of Medicine, Obafemi Awolowo University Teaching Hospital, ILE IFE, ¹University Teaching Hospital, Ado Ekiti, ²Osun State University, Osogbo, Nigeria

Address for correspondence: Dr. Ajayi E. Adekunle, Department of Internal Medicine, University Teaching Hospital, Iworoko Road, P.M.B 5355, Ado Ekiti, Nigeria. E-mail: lifecareado@gmail.com

ABSTRACT

Background: Left ventricular hypertrophy (LVH) is an independent cardiac risk factor in hypertensives and the structural classification of left ventricular (LV) geometry provides additional prognostic information. Ambulatory blood pressure (ABP) monitoring has been shown to be superior to office blood pressure (BP) in relation to hypertension LVH. We investigated ambulatory BP variables in relation to LV geometric patterns in Nigerian hypertensives. Materials and Methods: A total of 130 patients (males = 96, females = 34) with hypertension had their 24-hours ambulatory BP and trans-thoracic 2D/M- mode echocardiography. Data were analyzed with SPSS 13.0. P < 0.05 was considered statistically significant. Results: The mean age of the patients was 54.08±11.88 years. The prevalence rate of abnormal LV geometry was 48.4%. Mean ambulatory Systolic BP (day time, night time and 24-hour-average) was significantly higher in patients with LVH compared with those without LVH. Day-night systolic and diastolic BP decay (i.e. percentage nocturnal decline in BP) was also significantly lower in LVH group than in the group without LVH. Patients with eccentric LVH had abnormal day time mean ambulatory systolic BP, night time mean ambulatory systolic BP, elevated day time and night time systolic BP loads, as well as non-dipping diastolic BP pattern. Significant correlates of LV mass index in this study population were mean ambulatory systolic BP (day time: r = 0.355, P = 0.004; night time: r = 0.343, P = 0.005; 24- hour average: r = 0.358, P = 0.004) and day-night decay (systolic: r = -0.388, P = 0.007; diastolic: r = -0.290, P = 0.022) as well as 24-hour systolic BP variability. Conclusion: The presence of LVH in hypertension was associated with higher mean ambulatory systolic BP and lower percentage nocturnal decline in systolic and diastolic BP than its absence which appeared to be worse in patients with eccentric LV geometry when compared with other geometric patterns.

Key words: Ambulatory blood pressure, left ventricular geometry, hypertensives, Nigerians

INTRODUCTION

Ambulatory blood pressure (ABP) monitoring has been shown to be superior to office blood pressure (BP) in relation to hypertension target organ damage.[¹] A large number of studies, mostly among white population, have been investigated - on a cross-sectional basis, the organ damage accompanying hypertension is more closely related to 24-hour average than to office BP. The results have almost invariably shown this to be the case regardless of whether the damage is quantified in the heart (LVH or dysfunction), in the kidney (proteinuria), in the brain (cerebral lacunae or white matter lesions as identified by nuclear magnetic resonance), in the small and large arteries, or by a comprehensive organ damage score.[²,³]

In addition to left ventricular hypertrophy (LVH), which has been widely documented to be an independent cardiac
risk factor in both the general population and hypertensive patients,[4,5] the structural classification of LV geometry also provides useful and additional prognostic information.[6-8]

Though some authors have described LV geometric patterns in newly presenting hypertensive patients in Nigerian population,[9] no studies, to the best of our knowledge had investigated ABP variables in relation to LV geometric patterns in Nigerian hypertensive. This study, therefore sought to determine the relationship between ABP and LV geometric patterns in Nigerian hypertensive patients.

MATERIALS AND METHODS

The study population consisted of 130 patients (males = 96, females = 34) with hypertension (mean age 54.08±11.88 years) consecutively selected from those who were referred to the cardiac laboratory of Tender heart Specialist Clinic, Akure, Southwest Nigeria for non-invasive cardiac assessment. Ethical clearance for the study was approved by the Ethics and Research Committee of the University Teaching Hospital Ado Ekiti which the laboratory serves and all the participants gave written consent to participate in the study. Demographic parameters of subjects were noted and recorded. All subjects were clinically examined to evaluate their body mass index (BMI) and cardiovascular status. They were considered hypertensive if they had a resting systolic blood pressure (SBP) >140mmHg and/or diastolic blood pressure (DBP) >90mmHg measured after at least 15 minutes of rest in the sitting position with a mercury sphygmomanometer and adapted cuff at the brachial artery or if they were on antihypertensive therapy.[10] Korotkoff phase 1 was used for SBP and phase 5 for DBP. Three consecutive measurements were performed at 5-min intervals and the mean values for SBP and DBP were noted as office SBP and DBP, respectively. Excluded were patients with established chronic renal failure (CRF) or serum creatinine >1.5mg% (132 umol/L), ischemic heart disease, congestive heart failure, valvular heart disease, hemoglobinopathy and diabetes mellitus.

Ambulatory BP monitoring

Ambulatory BP was recorded using Schiller BR 102-Plus. The cuff was fixed to the non-dominant arm and the device was set to obtain automatic BP readings at 15-min intervals during the day time and at 30-min intervals during the night-time. The patient was then sent home with instructions to perform his or her usual activities, to hold the arm immobile at the time of the measurements, note on a diary the occurrence of any unusual events, and return 24-h later for device removal. Day time and night time periods were defined individually according to the patient self-reported data of going-to-bed and getting-up times. Interpretation of ABP profile was done according to the recommendations of the British Hypertension Society.[11] Percentage nocturnal BP decline was defined by calculating the percentage of decline in both SBP and DBP during the night, using the following formula: (day time BP–night time BP)/day time BP × 100. A normal dipping pattern (dipper) was diagnosed when the reduction in the average SBP during the night period was >10% of mean SBP during the day. An abnormal dipper pattern (non-dipper) was diagnosed when the night average SBP reduction was <10% with respect to day values.[12]

SBP and DBP loads in the entire 24-h and separately for the day time and night time were calculated. Day time and night time BP loads were calculated using a threshold of 140/90mmHg and 120/80mmHg respectively.[13] The individual loads are the percentage of elevated readings during each time period. SBP and DBP variability was assessed as the standard deviation of the mean (coefficient of variation) of 24-hour ambulatory SBP and DBP recordings.

Echocardiography assessment

All the patients had transthoracic 2D and 2D-derived M-mode echocardiography performed according to standard procedure, with simultaneous electrocardiographic recordings while in the left lateral decubitus position using a standard ultrasound machine (Philips SONOS 4500) with S3 transducer of frequency 3-1MHZ. LV end-diastolic and diastolic measurements were taken during at least three cycles[14] and included LV internal diameter (LVIDD), posterior wall thickness (PWT) and interventricular septal thickness (IVST). Left ventricular mass index (LVMI) was estimated from the American Society of Echocardiographic Formula (14) as stated below:

Estimated LVMI (g/m²) = 0.80 [1.04 (LVIDD + PWT + IVST)³ - (LVIDD)³] + 0.6g/BSA.

Upper normal limits for LV mass index were 134 and 110 g/m² in men and women.[15] Relative wall thickness (2 × posterior wall thickness/LV diastolic diameter) was calculated.[16] A partition value of 0.45 for relative wall thickness was used for both men and women.[17] Patients with increased LV mass index and increased relative wall thickness were considered to have concentric hypertrophy, and those with increased LV mass index and normal relative wall thickness were considered to have eccentric hypertrophy. Those with normal LV mass index and
increased or normal relative wall thickness were considered to have concentric remodeling or normal geometry, respectively.

**Statistical analysis**

Data are expressed as mean±SD and frequency as a percentage. Significant differences of the studied parameters between the four groups of LV geometry were determined by use of the analysis of variance (ANOVA). Multiple comparisons between the 4 groups were performed by one-way analysis of variance with the Tukey and Tamhane post hoc test. Student t test was used to compare two groups. Pearson’s correlation was used to investigate the correlation of variable factors.

All statistical analyses were performed with commercially available computer program SPSS 13.0 (SPSS Inc., Chicago, IL). *P* < 0.05 was considered statistically significant.

**RESULTS**

A total of 130 patients with a mean age of 54.08±11.88 years (range 31 -85 years) comprising 96 males and 34 females were studied. Sixty seven (51.5%) of the patients were on anti-hypertensive medications consisting mostly of calcium channel blockers, angiotensin receptor blockers/angiotensin converting enzyme inhibitors and thiazide diuretics. Figures 1 and 2 show the patterns of LV geometry in the study population in general and treatment groups, respectively. Sixty eight (51.6%) of the patients had normal LV geometry, 38 (29%) had LV concentric remodeling, 12 (9.7%) had LV concentric hypertrophy and 12 (9.7%) had LV eccentric hypertrophy. Clinical and demographic characteristics of the patients with respect to geometric patterns in the study population and the subgroup of patients who were not on anti-hypertensive drugs are shown in Tables 1a and 1b, respectively. There were no significant differences in sex, weight, height, and body surface area (BSA). The patients with eccentric LV geometry were older and had significantly higher office SBP compared to those with normal LV geometry, LV concentric geometry and LV concentric remodeling. Echocardiographic parameters of the different groups are shown in Tables 2a and 2b. There were no significant differences in the echocardiographic LV systolic function indices of ejection fraction and fractional shortening. There was no significant difference in left atrial dimension and aortic root dimension between the groups, in the study population. However, patients with eccentric LV geometric pattern who were found only in

![Figure 1: Left ventricular geometric pattern in the study population](image)

![Figure 2: Left ventricular geometric pattern in patients on antihypertensive vs. no antihypertensive medications](image)

**Table 1a: Demographic characteristics of different geometric patterns in the study population**

| Variable          | Normal n=68 | Concentric hypertrophy n=12 | Eccentric hypertrophy n=12 | Concentric remodeling n=38 | *P* value* |
|-------------------|-------------|------------------------------|-----------------------------|-----------------------------|------------|
| Age               | 47.73±12.97 | 59.67±5.96                   | 67.00±2.68                  | 52.46±12.12                 | 0.007      |
| Sex               | -           | -                            | -                           | -                           | 0.410      |
| Male n(%)         | 46 (35.39)  | 8 (6.15)                     | 8 (6.15)                    | 34 (26.15)                  | -          |
| Female n(%)       | 22 (16.92)  | 4 (3.08)                     | 4 (3.08)                    | 4 (3.08)                    | -          |
| Weight            | 77.84±12.58 | 99.07±11.13                  | 79.67±10.93                 | 87.00±19.44                 | 0.109      |
| Height            | 168.38±7.25 | 169.08±0.00                  | 168.67±6.08                 | 170.64±7.32                 | 0.848      |
| BMI               | 27.70±4.62  | 34.66±5.65                   | 28.01±3.45                  | 29.87±6.15                  | 0.202      |
| BSA               | 1.90±0.22   | 1.98±0.17                    | 1.69±0.42                   | 1.93±0.21                   | 0.160      |
| Office SBP        | 129.08±13.69| 140.00±1.00                  | 164.00±17.25                | 152.90±10.67                | <0.001     |
| Office DBP        | 84.38±10.65 | 90.00±6.07                   | 90.00±8.944                 | 98.18±6.78                  | 0.002      |
| Pulse pressure    | 46.33±11.90 | 45.00±5.77                   | 74.00±9.47                  | 51.57±10.47                 | <0.001     |

*BSA: Body Surface Area; BMI: Body Mass Index. *P* value <0.05 is statistically significant.
those who were not on antihypertensive medications had significantly higher left atrial dimension than other forms of LV geometric pattern.

When the patients were stratified using only LVMI to normal LVMI and increased LVMI (i.e. LVH) as shown in Table 3a, patients with LVH were found to be significantly older with higher office SBP than those without LVH. In similar vein, mean ambulatory SBP (day time, night time and 24-hour- average) was significantly higher in patients with LVH compared with those without LVH. Day-night SBP and DBP decay (i.e. percentage nocturnal decline in BP) were also significantly lower in LVH group than in the group without LVH. A similar trend was observed when a subgroup of those who were not on antihypertensive drugs was separated and was similarly compared [Table 3b].

Tables 4a and 4b depict ABP parameters of different LV geometric patterns.
Table 3a: Ambulatory blood pressure parameters of normal and increased left ventricular mass index in the study population

| Variable     | Normal n=104 | LVH n=26 | P value* |
|--------------|--------------|----------|----------|
| Age          | 49.60±11.73  | 61.83±6.70 | 0.001    |
| Sex          |              |           | 0.371    |
| Male n(%)    | 80 (61.54)   | 17 (13.08) | -        |
| Female n(%)  | 24 (18.46)   | 9 (6.92)   | -        |
| BMI          | 28.55±5.03   | 29.07±3.95 | 0.759    |
| Office SBP   | 137.45±17.03 | 154.40±17.86 | 0.007   |
| Office DBP   | 89.46±13.07  | 92.00±7.89  | 0.558    |
| Mean systolic (mmHg) |          |           |          |
| Day          | 130.26±12.92 | 139.00±12.05 | 0.037    |
| Night        | 118.72±11.80 | 134.50±18.15 | 0.006    |
| 24-hour      | 127.14±13.10 | 130.00±12.11 | 0.011    |
| Mean diastolic (mmHg) |        |           |          |
| Day          | 80.52±10.94  | 77.83±6.19  | 0.417    |
| Night        | 69.78±10.47  | 75.00±10.14 | 0.124    |
| 24-hour      | 77.62±10.59  | 76.83±6.53  | 0.807    |
| Mean MAP (mmHg) |          |           |          |
| Day          | 98.92±1.47   | 102.33±8.67 | 0.300    |
| Night        | 85.76±20.54  | 100.50±17.31 | 0.025    |
| 24-hour      | 96.06±10.56  | 101.83±10.53 | 0.094    |
| Day-night decay |        |           |          |
| Systolic     | 9.36±6.61    | 3.17±10.21  | 0.012    |
| Diastolic    | 13.02±6.28   | 3.50±10.17  | <0.001   |

BMI- Body Mass Index, *P value <0.05 is statistically significant

Table 3b: Ambulatory blood pressure parameters of normal and increased left ventricular mass index in untreated hypertensives

| Variable     | Normal n=42 | LVH n=21 | P value* |
|--------------|-------------|----------|----------|
| Age          | 52.20±6.62  | 62.00±7.39 | 0.001    |
| Sex          |              |           | 0.371    |
| Male n(%)    | 36 (57.15)   | 17 (26.98) | -        |
| Female n(%)  | 6 (9.52)     | 4 (6.35)   | -        |
| BMI          | 27.83±3.31   | 29.67±4.24 | 0.719    |
| Office SBP   | 143.75±13.58 | 154.40±17.85 | 0.019    |
| Office DBP   | 93.50±13.92  | 92.00±7.80  | 0.133    |
| Mean systolic (mmHg) |        |           |          |
| Day          | 133.15±11.41 | 142.20±10.44 | 0.045    |
| Night        | 121.20±13.61 | 138.80±16.71 | 0.024    |
| 24-hour      | 129.75±11.36 | 141.60±9.62  | 0.033    |
| Mean diastolic (mmHg) |        |           |          |
| Day          | 83.35±12.28  | 79.20±5.87  | 0.150    |
| Night        | 71.50±10.73  | 78.00±8.11  | 0.411    |
| 24-hour      | 80.15±11.79  | 78.60±5.60  | 0.162    |
| Mean MAP (mmHg) |          |           |          |
| Day          | 101.90±10.32 | 104.20±8.28 | 0.849    |
| Night        | 83.55±27.73  | 103.80±17.13 | 0.042    |
| 24-hour      | 98.55±9.85   | 104.00±10.22 | 0.120    |
| Day-night decay |        |           |          |
| Systolic     | 8.90±7.03    | 2.20±11.00  | 0.004    |
| Diastolic    | 14.10±4.13   | 1.20±9.55   | <0.001   |

BMI- Body Mass Index, *P value <0.05 is statistically significant

Analysis of frequencies of occurrence of normal and abnormal ABP variables in the study population showed that though all patients with eccentric LVH had normal day time mean ambulatory DBP, they all had abnormal day time mean ambulatory SBP, night time mean ambulatory SBP, elevated day time and night time SBP loads, as well as non-dipping DBP pattern. All the patients with concentric remodeling geometry had their night time DBP load elevated. Overall, 111(85.39%) of the patients had night time SBP load > 20%.

Significant correlates of LV mass index in this study population were age (r = 0.291, P = 0.022), mean ambulatory SBP (day time: r = 0.355, P = 0.004; night time: r = 0.343, P = 0.005; 24-hour average: r = 0.358, P = 0.004) and day-night decay (systolic: r = -0.388, P = 0.007; diastolic: r = -0.290, P = 0.022). Total (24-hours) SBP (r = 0.379, P = 0.022), total SBP (r = 0.358, P = 0.005; 24-hour average: r = 0.358, P = 0.005) and night time SBP (r = 0.343, P = 0.005; 24-hour average: r = 0.343, P = 0.005) were found to be significant predictors of LV mass index. Analysis of frequencies of occurrence of normal and increased left ventricular mass index in the study population showed that though all patients with eccentric LVH had normal day time mean ambulatory DBP, they all had abnormal day time mean ambulatory SBP, night time mean ambulatory SBP, elevated day time and night time SBP loads, as well as non-dipping DBP pattern. All the patients with concentric remodeling geometry had their night time DBP load elevated. Overall, 111(85.39%) of the patients had night time SBP load > 20%.

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DISCUSSION

In this study, the prevalence of LVH was 20% which is comparable with that reported earlier in an unselected population of hypertensive patients like ours. The prevalence of abnormal LV geometry was 48.4% and LV concentric remodeling constituted the majority (29%) while eccentric hypertrophy and concentric hypertrophy had similar prevalence of 9.7% apiece. This is in contrast with work by Aje et al at Ibadan, south western Nigeria where more than two third of their hypertensive patients had various altered LV geometry. The proportional prevalence of different altered LV geometry in that study also differs with this study. The reason for this difference may be related to the patient selection, use of different formulae and partitioning values for LVMI estimation. While our patients were unselected hypertensives, theirs were newly presenting hypertensives.

It was noted that patients with abnormal geometry were older with higher office systolic and mean ambulatory SBP (day time, night time and 24-hour average). Some authors have suggested that age significantly affects the occurrence of altered LV structure and geometric pattern in an upward trend fashion

Although increased LV mass predicts greater risk of cardiovascular events, independently of the presence of other risk factors, the role of LV geometry as an independent predictor of cardiovascular morbidity and mortality has been a controversial issue. The prospective study of Koren et al showed that patients with normal LV architecture had the best prognosis; those with concentric LV hypertrophy had the worst and the other groups...
intermediate prognosis while there was no attenuation of risk over a period of 10 years despite conventional hypertensive treatment of most patients. The findings from the Framingham Heart Study\[19, 20\] confirmed that subjects with concentric LV hypertrophy had the worst prognosis, followed by those with eccentric LV hypertrophy, concentric LV remodeling and normal LV geometry. The role of LV geometry as an independent predictor of cardiovascular morbidity and mortality was further emphasized by Verdecchia \textit{et al}\[21\] who found that in hypertensive patients with normal LV mass on echocardiography, concentric LV remodeling was an important and independent predictor of increased cardiovascular risk. Though this is not a study on prognostic value of LV geometry, it was observed that patients with EH were older, with significantly higher office SBP, ambulatory SBPs and LV mass index.

In this study, ambulatory blood pressure variables at night time and 24-hour average were significantly higher among patients with altered LV geometry compared with normal geometry. This also was the case with mean SBP and mean DBP at night and 24-hour average as well as peak systolic and DBP at night. Cross-sectional studies which have investigated whether the target organ damage accompanying hypertensives is more closely related to 24-hour average than office BP have almost invariably shown this to be the case. In addition, findings of the study on ambulatory monitoring of pressure and lisinopril Administration (SAMPLE) also provided evidence that the end organ damage of hypertension is related to day time, night time and 24-hour average ABPs.\[1\]

A large number of studies have come to the conclusion that in hypertensive subjects in whom nocturnal BP falls was less than 10%, organ damage is much greater than in those in whom it falls more than 10% and that this is

| Table 4a: Ambulatory blood pressure parameters of different geometric patterns in the study population |
|---------------------------------|-----------|-----------|-----------|-----------|-----------|
| Variable                       | Normal n=68 | Concentric hypertrophy n=12 | Eccentric hypertrophy n=12 | Concentric remodeling n=38 | P value* |
| Mean systolic (mmHg)           |         |         |         |         |
| Day                            | 128.46±14.35 | 135.67±15.21 | 142.33±7.82 | 133.44±9.44 | 0.078  |
| Night                          | 116.41±14.59 | 132.33±15.21 | 136.67±21.95 | 122.83±19.93 | 0.025  |
| 24 hour                        | 125.19±14.07 | 135.00±13.42 | 141.00±10.99 | 130.61±10.65 | 0.030  |
| Mean diastolic (mmHg)          |         |         |         |         |
| Day                            | 77.69±11.66 | 79.33±7.17 | 76.33±2.54 | 85.55±7.45 | 0.057  |
| Night                          | 66.43±9.57 | 70.00±7.75 | 80.00±10.32 | 75.72±9.51 | 0.002  |
| 24 hour                        | 74.69±11.01 | 76.67±7.23 | 77.00±7.56 | 82.83±7.56 | 0.044  |
| Peak systolic (mmHg)           |         |         |         |         |
| Day                            | 167.66±22.95 | 174.33±32.12 | 182.67±17.92 | 170.83±24.70 | 0.548  |
| Night                          | 140.78±18.98 | 164.67±21.28 | 156.67±23.26 | 148.61±20.28 | 0.033  |
| Peak diastolic (mmHg)          |         |         |         |         |
| Day                            | 112.44±18.85 | 115.00±5.59 | 102.00±10.84 | 128.78±24.40 | 0.012  |
| Night                          | 83.75±15.59 | 97.00±17.96 | 96.67±14.76 | 102.33±23.19 | 0.008  |
| Mean MAP (mmHg)                |         |         |         |         |
| Day                            | 96.91±11.13 | 103.33±8.12 | 101.33±9.85 | 102.50±8.30 | 0.197  |
| Night                          | 81.09±22.15 | 97.00±12.10 | 104.00±21.98 | 94.06±14.41 | 0.017  |
| 24 hour                        | 93.84±10.74 | 101.67±8.31 | 102.00±13.24 | 100.00±9.29 | 0.082  |
| Systolic load (%)              |         |         |         |         |
| Day                            | 27.75±5.77 | 34.67±9.76 | 54.67±8.11 | 38.56±6.25 | 0.089  |
| Night                          | 41.16±3.32 | 69.67±8.78 | 66.67±3.72 | 47.11±8.16 | 0.110  |
| 24 hour                        | 31.44±5.86 | 45.33±8.62 | 57.67±7.12 | 41.17±7.51 | 0.040  |
| Diastolic load (%)             |         |         |         |         |
| Day                            | 22.50±6.63 | 23.33±7.11 | 12.00±5.87 | 30.11±7.04 | 0.398  |
| Night                          | 21.22±7.98 | 25.67±3.53 | 52.66±5.34 | 44.89±8.22 | 0.009  |
| 24 hour                        | 21.25±6.13 | 23.67±8.01 | 22.67±7.05 | 34.16±9.88 | 0.295  |
| MAP load (%)                   |         |         |         |         |
| Day                            | 10.16±6.93 | 17.33±5.96 | 16.33±6.27 | 10.72±4.79 | 0.596  |
| Night                          | 18.03±5.28 | 37.33±8.91 | 36.67±9.26 | 31.44±5.25 | 0.156  |
| 24 hour                        | 12.25±8.01 | 23.67±6.10 | 21.33±7.01 | 16.50±6.92 | 0.369  |
| Systolic day-night decay       |         |         |         |         |
| Day                            | 11.22±5.85 | 4.99±2.99 | 4.33±3.37 | 9.61±5.02 | 0.087  |
| Diastolic day-night decay      |         |         |         |         |
| Day                            | 14.17±6.34 | 11.67±4.76 | -4.67±6.94 | 11.56±7.84 | <0.001 |

*P value <0.05 is statistically significant
the case also for the organ damage progression and the incidence of cardiovascular disease.\textsuperscript{[20,21]} In our study, day-night systolic and diastolic decay was significantly reduced in those patients with LVH compared with those without LVH. In addition, day-night systolic and diastolic decay was significantly lower than 10% in all the strata of altered geometric pattern but worst in patients with eccentric LV geometry.

Twenty-four-hour-average SBP correlated with LVMI in our study. This is in agreement with studies by Rowlands et al\textsuperscript{[22]} and Devereux et al\textsuperscript{[23]} ($r = 0.36, 0.35$ and 0.31, respectively). However, correlation coefficients of day time systolic and night time SBPs in our study were generally lower than in Rowlands but much better than Devereux. Our findings of inverse relation between the percentage decline in nocturnal BP and LV mass index is significant. This further confirms the importance of ‘non-dipping’ of nocturnal blood pressure as earlier described by O’Brien et al\textsuperscript{[23]} on the development of LVH and its consequential increased cardiovascular risk.

Though mean ambulatory systolic and DBPs (night time and 24-hour average) were statistically significant among the LV geometric patterns, ambulatory systolic pressures were the significant correlates of LVMI in this study. LV wall stress is mostly related to SBP which may explain this finding.

One of the major limitations of this study is the small sample size. It was also difficult to determine the length of treatment for those who were on medications. Nonetheless, it is still possible to draw some significant conclusions from this study.

In conclusion, this study had demonstrated that in Nigerian hypertensive patients, presence of LVH is associated

| Variable | Normal n=26 | Concentric hypertrophy n=8 | Eccentric hypertrophy n=12 | Concentric remodeling n=17 | P value* |
|----------|-------------|-----------------------------|-----------------------------|-----------------------------|---------|
| Mean systolic (mmHg) | | | | | |
| Day | 134.75±12.04 | 142.00±15.01 | 142.33±7.82 | 130.75±10.70 | 0.214 |
| Night | 124.50±14.51 | 142.12±3.46 | 136.67±21.95 | 116.25±11.21 | 0.022 |
| 24 hour | 132.00±12.04 | 142.50±8.66 | 141.00±10.99 | 126.38±10.06 | 0.047 |
| Mean diastolic (mmHg) | | | | | |
| Day | 82.75±15.88 | 83.55±4.04 | 76.33±5.24 | 84.25±3.41 | 0.550 |
| Night | 70.42±13.56 | 75.00±7.36 | 80.00±10.32 | 73.12±6.36 | 0.324 |
| 24 hour | 79.50±15.29 | 81.01±3.46 | 77.00±7.56 | 81.12±2.85 | 0.894 |
| Peak systolic (mmHg) | | | | | |
| Day | 172.25±18.31 | 188.00±31.17 | 182.67±17.92 | 165.25±15.90 | 0.207 |
| Night | 154.33±17.03 | 177.50±9.82 | 156.67±23.26 | 145.88±9.03 | 0.031 |
| Peak diastolic (mmHg) | | | | | |
| Day | 117.83±24.23 | 112.50±5.20 | 102.00±10.84 | 127.50±16.33 | 0.108 |
| Night | 87.42±16.30 | 104.00±16.48 | 96.67±14.76 | 101.50±22.62 | 0.024 |
| Mean MAP (mmHg) | | | | | |
| Day | 102.58±12.72 | 108.50±1.73 | 101.33±9.85 | 100.85±7.77 | 0.623 |
| Night | 80.33±35.73 | 103.50±8.66 | 104.00±21.98 | 88.36±6.09 | 0.014 |
| 24 hour | 99.58±12.28 | 107.00±1.16 | 102.00±13.24 | 07.00±4.69 | 0.239 |
| Systolic load (%) | | | | | |
| Day | 39.33±3.43 | 47.00±3.00 | 54.67±8.11 | 31.12±2.81 | 0.409 |
| Night | 55.50±3.24 | 94.50±6.35 | 66.67±7.32 | 45.75±2.24 | 0.200 |
| 24 hour | 43.75±2.81 | 61.50±1.78 | 57.67±7.12 | 35.13±2.18 | 0.042 |
| Diastolic load (%) | | | | | |
| Day | 39.00±4.79 | 33.50±6.86 | 52.66±5.34 | 41.00±1.42 | 0.032 |
| Night | 33.67±3.80 | 33.50±2.59 | 52.66±5.34 | 41.00±1.42 | 0.032 |
| 24 hour | 32.83±3.91 | 33.00±1.38 | 22.67±7.05 | 22.75±2.97 | 0.552 |
| MAP load (%) | | | | | |
| Day | 18.25±2.50 | 24.50±1.73 | 16.33±6.27 | 9.63±4.37 | 0.595 |
| Night | 30.33±2.97 | 56.00±1.98 | 36.67±9.26 | 21.75±5.31 | 0.303 |
| 24 hour | 21.50±2.59 | 34.50±2.31 | 21.33±7.01 | 13.13±2.71 | 0.445 |
| Systolic day-night decay | 7.50±4.42 | -1.00±1.27 | 4.33±3.37 | 11.00±4.51 | 0.147 |
| Diastolic day-night decay | 14.75±2.86 | 10.01±4.62 | -4.67±6.94 | 13.13±5.61 | <0.001 |

*P value <0.05 is statistically significant
with higher mean ambulatory SBP and lower percentage nocturnal decline in systolic and DBP than its absence. These abnormalities appeared to be worse in patients with LV eccentric geometry when compared with other patterns of LV geometry, especially in untreated hypertensive patients.

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