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Ambulatory Blood Pressure Monitoring in Young Hypertensive Patients

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Abstract **Original Research Article**

Background: Hypertension is one of the leading causes of the global burden of disease and is a major risk factor for cardiovascular disease, stroke and renal failure. Since younger patients are easily susceptible to reactive hypertension and may have low pre-test probability of hypertension, in this context we aimed at measuring Ambulatory blood pressure monitoring(ABPM) to differentiate true from white coat hypertension and to identify dippers and non-dippers . ***Methods:*** A total of forty six newly diagnosed hypertensive patients based on clinic BP measurement from out-patient department with age ranging from 18-40years were included. All were subjected to ABPM by using ABPM-05 machine from Meditech Ltd. and Easy ABPM 1.1.1.0 as program. ***Results:*** The mean age of the subjects was 31.67±5.43 yrs, among them 35 were males and 11 were females. Out of total 46, 38 patients had true hypertension and 8 had white coat hypertension. Dipping was the most common (30) finding followed by non-dipping (16). Non dipping pattern is seen more in females (7 out of 11) than males. It is observed that the Haemoglobin levels in dippers was significantly higher as compared to subjects with non-dipping pattern (14.4 vs 12.2, p=0.001). Serum albumin were also higher in dippers when compared to non-dippers (4.33g/dl vs 3.84 g/dl, p=0.04). ***Conclusion:*** Ambulatory blood pressure monitoring is a very important tool to identify white coat hypertension, where they may not benefit from immediate antihypertensive treatment so as to avoid overtreatment and also identify non dippers which was sought to be a cardio-vascular risk factor.

Keywords: Ambulatory blood pressure monitoring (ABPM), White coat hypertension, Dippers, Non – Dippers, Diurnal index.

INTRODUCTION

Hypertension in young is being diagnosed with increasing frequency. [1] The global obesity epidemic is leading to a shift in the blood pressure (BP) distribution toward increasing levels in children and adolescents. [2] Although antihypertensive therapy reduces the risks of cardiovascular and renal disease, large segments of the hypertensive population are either untreated or inadequately treated.

Traditionally, BP in the office or clinic has been assessed with the auscultatory technique. But, there is an increasing awareness of the intrinsic variability of blood pressure [3] and the fact that the conventional clinic measurements of pressure may in some patients be quite unrepresentative of their overall levels of blood pressure [4].

In this regard, two techniques including ambulatory blood pressure monitoring (ABPM) and home (self) blood pressure monitoring (HBPM) have been developed to estimate true BP [5].

Ambulatory BP monitoring (ABPM), which can more precisely characterize changes in BP throughout daily activities, has been found to be superior to clinic BP (CBP) monitoring in predicting cardiovascular morbidity and mortality. For this reason, ABPM is seeing more widespread use in evaluation for hypertension and risk of end-organ damage in adults [6].

MATERIALS AND METHODS

Aims and objectives

- To establish hypertension by Ambulatory blood pressure monitoring in newly detected young hypertensive patients.
- To identify dippers and non-dippers

It is a Cross sectional observational study done in out-patients attending to departments of general medicine, nephrology, cardiology of Nizam's Institute of Medical Sciences, Hyderabad, Telangana, India. Study was conducted From August 2015 to September 2016 after taking clearance from hospital ethics committee.

Inclusion criteria

- Systolic blood pressure >140mmHg or diastolic blood pressure >90mmHg by sphygmomanometer for the first time (newly diagnosed).
- Age more than 18 years and less than or equal to 40 yrs.

Exclusion criteria

- Age less than 18 years
- Pregnancy
- Not given informed consent
- On oral anti-hypertensive drugs for more than 1 week.

METHODOLOGY

Patients who fulfilled the inclusion criteria were recruited in the study, after taking a written informed consent. Detailed clinical examination was conducted and routine investigations like hemogram, renal function tests (blood urea, creatinine), serum electrolytes, liver function tests, random blood glucose, lipid profile, thyroid profile, complete urine examination, urine spot PCR, ultrasound abdomen were done in all the subjects. Renal artery doppler, ECG, 2D Echo was done in subjects as required.

We studied ambulatory blood pressure profile with ABPM-05 machine from Meditech Ltd and Easy ABPM 1.1.1.0 as program. ABPM-05 is a programmable, oscillometric ambulatory blood pressure monitor, which is typically worn by the patient for 24 hours.

For the recruited patients, ABPM-05 machine was hooked up in non-dominant arm if blood pressure difference between two arms was less than 10% or to arm with high blood pressure if blood pressure difference was more than 10%. Measurement durations were every 15-min during daytime (between 06:00 and 22:00) and every 30-min during night time (between 22:00 and 06:00 AM). The BP monitoring was habitually performed over a working day (Monday to Friday).The patients were instructed to attend their usual day-to day activities but to keep with their measurement times.

When complete, the device was connected to a computer that prepares a report of the 24-hour blood pressure profile. The recording was then analyzed to obtain 24-hour daytime and night-time averages for SBP, DBP and diurnal index. The diagnosis of hypertension was based on accepted ABPM criteria (ESH guidelines 2013)[7].

STATISTICAL ANALYSIS

Results on continuous measurements are presented on mean ± SD and categorical variables are presented in number (%). Significance was assessed at 5% level of significance. Student't test (two tailed, independent) was used to find the significance of study parameters on continuous scale between two groups (Inter group analysis). Chi-square test was used to find the significance of study parameters on categorical scale between two groups. Logistic regression model was developed with the data obtained.

RESULTS

Our study included a total of 46 subjects. Of the total subjects, 35 were males and 11 were females. The baseline characteristics of studied subjects are shown in table 1.

Table-1: Baseline characteristics of the study population

Total subjects	**46**
Age (years)	31.67 ± 5.43
Men	35
Women	11
White coat hypertension	8
Dipper	5
Nondipper	3
True hypertension	38
Dipper	25
Nondipper	13
Mean clinic SBP	145.8 ± 10.5
Mean clinic DBP	93.91±6.85
Mean 24hr Ambulatory SBP	133.15±13
Mean 24hr Ambulatory DBP	84.56±9.98
Mean 24hr ambulatory MAP	100.8±10.52
BMI (kg/m^2)	25.46 ± 4.68
Diurnal index	10.1±6.16

Among the 46 studied subjects, 8 had white coat hypertension and 38 had true hypertension. In 38 Hypertensive subjects, dipping pattern is seen in 25 subjects and rest 13 subjects had non dipping pattern.

The descriptive analysis of the studied subjects is shown in table 2.

Table-2: Summary of descriptive analysis of our study subjects

	Dipper(n=30)	**Nondipper(n=16)**	**p-value**
Age(years)	31.43(5.79)	32.125(4.82)	0.686
Gender			
• Male	26	9	
• Female	4	7	**0.021***
Body mass index(kg/m^2)	25.67(4.37)	25.082(5.20)	0.684
Ambulatory BP measurements			
• 24hr SBP(mmHg)	132.73	133.9	0.769
• 24hr DBP(mmHg)	84.6	84.5	0.97
• 24hr MAP(mmHg)	100.5	101.18	0.85
• 24hr Pulse pressure	49.43	51.6	0.53
• Awake SBP(mmHg)	138.8	135.8	0.47
• Awake DBP(mmHg)	89.76	86.18	0.259
• Night SBP(mmHg)	120.26	130.9	**0.01***
• Night DBP(mmHg)	73.96	81.62	**0.03***
• Morning surge	18.067(13.33)	9.188(8.47)	**0.02***
Serum biochemical markers			
• Hemoglobin(g/dl)	14.74	12.2	**0.001***
• Random blood sugar(mg/dl)	99	157.6	**0.01***
• TSH(µIU/ml)	2.9	5.1	**0.05***
• Blood. Urea(mg/dl)	19.25	36.23	**0.02***
• S.Creatinine(mg/dl)	0.87(0.19)	1.88(2.6)	**0.045***
• Total.Cholesterol(mg/dl)	183.7(50.97)	201(55)	0.40
• LDL.Cholesterol(mg/dl)	113.9(43.1)	116(44.4)	0.90
• HDL.Cholesterol(mg/dl)	39.68(7.6)	43.2(13.3)	0.37
• VLDL.Cholesterol(mg/dl)	34.6(12.62)	41.5(21.62)	0.28
• Triglicerides(mg/dl)	167.5(69)	200(95)	0.3
• Albumin(g/dl)	4.33(0.65)	3.8(0.65)	**0.047***

Values are mean ± SD. BP, blood pressure; SBP, systolic BP; DBP, diastolic BP; MAP-mean arterial pressure. HDL-C, high-density lipoproteincholesterol; LDL-C, low-density lipoprotein cholesterol; VLDL-C very low density lipoprotein cholesterol; TSH-Thyroid stimulating hormone

The mean age of the total subjects was 31.67 ± 5.43 yrs. The Mean age of the subjects having dipping pattern was 31.43 yrs whereas in subjects having non dipping pattern, the mean age was 32.13 yrs (p=0.68). Among 46 subjects, male were 35 and female were 11. Out of 11 females, 7 had non-dipping pattern. It was statistically significant (p=0.021). The number of smokers was higher in subjects with non-dipping pattern when compared to dipping pattern. Out of 46 subjects, 17 were alcoholic and 29 were non-alcoholics (p 0.957) and there was no significant difference between dippers and non-dippers. Out of 46 subjects 33 had a family history of hypertension. The number of subjects with positive family history was higher in dippers as compared to non-dippers.

The mean systolic blood pressure in dippers was 132.73mmHg and in non-dippers 133.89 mmHg (p= 0.76). The mean diastolic blood pressure in dippers was 84.6mmHg and in non-dippers 84.5mmHg (p = 0.975). 24 hour mean arterial pressure in dippers was 100.56 mmHg and in non-dippers was 101.18 mmHg (p=0.85). The 24 hour mean pulse pressure in dippers was 49.43mmHg and in non-dippers 51.68mmHg (p=0.53). The mean blood pressure variability was higher in dippers as compared to non-dippers (p=0.148). However these data are not statistically significant.

The mean diurnal index in dippers was 13.5 and in non-dippers were 3.68 which is statistically Significant (Figure 1). The mean morning surge in dippers (Figure 2) was significantly higher in dippers as compared to subjects with non-dipping pattern (p=0.02). The mean SBP in passive period in dippers was 120.2mmHg and in non-dippers 130.9 mmHg (p = 0.014). The mean DBP in passive period in dippers was 73.96 mmHg and in non-dippers 81.62 mmHg (p=0.03) which was statistically significant.

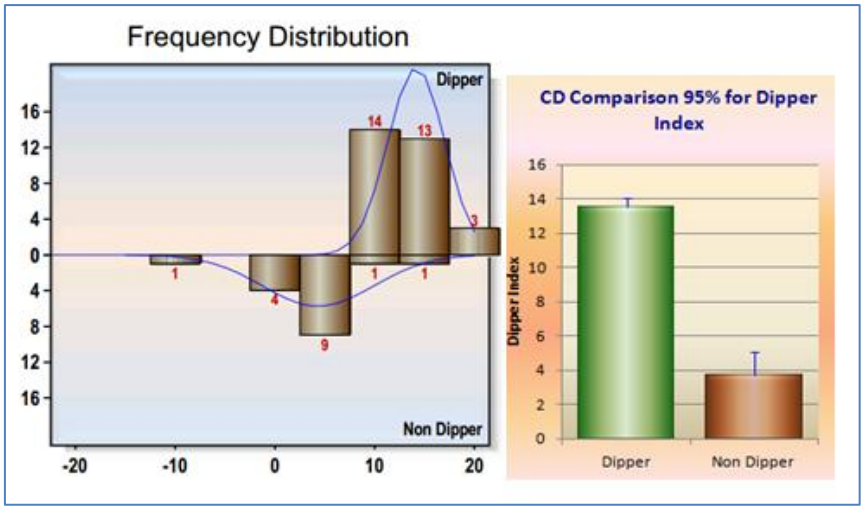

Fig-1(a): Frequency of diurnal index in dippers and non-dippers; (b) Diurnal index in dippers and non-dippers

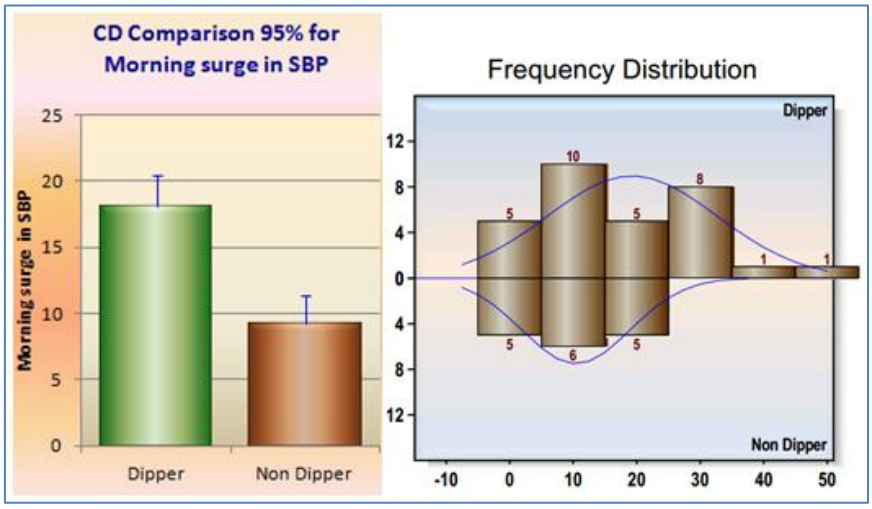

Fig-2 (a): Morning surge in systolic blood pressure in dippers and non-dippers; (b) frequency of morning surge in systolic blood pressure in dippers and non-dippers

The Haemoglobin levels in dippers was significantly higher as compared to subjects with non-dipping pattern (14.4 vs 12.2, p=0.001). The random blood glucose was significantly higher in non-dippers as compared to subjects with dipping pattern (158 vs 100, p=0.01). Among the studied subjects, 3 patients had diabetes and all 3 are from subjects with non-dipping pattern. The mean spot protein creatinine ratio in dippers was 0.17 and in subjects with non-dipping pattern was 3.88 (p=0.08). The mean serum creatinine in total subjects was 1.23±1.62 mg/dl. In dippers 0.87 mg/dl and in non-dippers was 1.88 mg/dl (p value 0.045). The Serum mean albumin was 4.15±0.69 g/dl. In dippers it was 4.33g/dl and in non-dippers 3.84 g/dl (p=0.04).

Among 46 patients, 8(17%) had secondary hypertension,, out of which 6 patients had renal disease (4 had chronic kidney disease, 1 had nephrotic syndrome, 1 had polycystic kidney disease), one patient had takayasu arteritis and another patient had hypereosiniphilic syndrome.

DISCUSSION

There is mounting evidence that ambulatory blood pressure monitoring (ABPM) is superior to clinical blood pressure (BP) in the diagnosis and prognostic evaluation of hypertensive subjects, as it provides a large number of measurements taken during daily activities and sleep.

In the present study, a total of 46 subjects with hypertension who were newly diagnosed, less than 40 years and not on antihypertensive medication were enrolled. Twenty-four hour ABPM was used to determine BP dipping status. Among the 46 subjects, 35(76%) were males and 11(24%) were females. We found 8 (17%) subjects having white-coat hypertension and 38 (83%) having true hypertension as observed by ambulatory blood pressure monitoring.

In a study by Gustavsen *et al*. showed that white-coat hypertension should be regarded as a cardiovascular risk factor. In this study 18.1% of the 42 hypertensives had White-coat hypertension [8]. In our

study, we found 17% of the subjects having white-coat hypertension.

With the use of the 24-hour ABPM, researchers have observed that BP usually fluctuates in a diurnal manner. Individuals with this normal night-time reduction are known as dippers, whereas the normal nocturnal fall of BP is diminished or blunted, the term "non-dipper" [9]. The lack of nocturnal fall in BP has been related to an increase in target organ damage and cardiovascular events. In our study out of 46 subjects, 30(65.2%) were dippers and 16(34.8%) were non-dippers. In a study by Manchang Liu *et al*. found that 56 out of 80 (70%) patients were defined as non-dippers and the other 24 (30%) as dippers [10].

Diurnal index was calculated to know the dipping status.
Diurnal index (DI) = ([mean daytime ABPM - mean night-time ABPM]/mean daytime ABPM) x 100 [11].

Four dipping categories have been described, based on the diurnal index from 24-h ambulatory blood pressure recordings: extreme dippers (DI >20%), dippers (DI 10% -20%), non-dippers (DI 0%-10%) and reverse dippers (DI <0%). A 'non-dipping BP profile' is usually defined as a nocturnal BP fall of less than 10%.In our study, out of 16 non-dippers, one subject is having reverse dipping or raiser pattern and none of the subjects had extreme dipping pattern.

In our study, we compared the subjects with dipping pattern and those with non-dipping pattern with various parameters to identify the risk factors associated with non-dipping pattern.

Out of the total subjects enrolled in the study, 11(24%) were females and 35(76%) were males. Out of 11 females, 7 were non-dippers (p value=0.02). There are no studies for reference regarding the association of non-dipping pattern and female sex.

Some researchers have also reported greater target organ damage among hypertensive non-dipping women than among hypertensive non-dipping men.

In patients with CKD, non-dipping was related to faster progression of kidney disease. Non-dipping is thought to be a compensatory phenomenon to produce natriuresis in volume-overloaded patients. If so, then early kidney disease would be associated with volume overload and result in non-dipping. This would explain the high prevalence of non-dipping in patients with mild proteinuria or early impairment of GFR.Thus, the change in pattern of BP would be an earlier sign of kidney disease and/or the occurrence of endothelial dysfunction. In a study by Timio *et al*. [12] reported that the non-dippers had a faster rate of creatinine Sclearance decline than the dippers. Also the urinary protein excretion increase was higher in the non-dipper group than in the dipper group. In Yusuf Selcoki *et al*. [13] study the spot urine creatinine ratio was significantly higher in the non-dipper group. In our study, we found that mean spot protein creatine ratio in dippers was 0.17 and in non-dippers 3.88 (p=0.08).

The use of biological and physiological markers greatly improved the prediction of outcome. In order to analyze the dipping/non-dipping as predictor outcome, we used the logistic regression model. The multi variant analysis showed good area under the curve in receiver operating characteristic curve (AUC=1.00) and its prediction was excellent indicating that by cumulating the data, they can predict the dipper status.

CONCLUSION

- In our study, it is observed that non-dipping pattern was found to be significantly higher in female subjects.
- There was a significant increase in night SBP, night DBP, and significant decrease in morning surge in subject with non-dipping pattern.
- There was no significant differences in age, BMI, 24 hr mean SBP, DBP, MAP, Pulse pressure, awake SBP, awake DBP, among subjects with dipping and non-dipping pattern
- Random blood glucose, serum TSH, urea, creatinine was significantly higher in subjects with non-dipping pattern as compared to subjects with dipping pattern.
- As compared to dippers, the haemoglobin and serum albumin levels were significantly low in non-dippers.
- There was no significant difference in lipid profile, among dippers and non-dippers.
- The present study highlighted the importance of measuring the ambulatory BP monitoring in differentiating white-coat hypertension with true hypertension and also to identify dippers from non-dippers.

LIMITATIONS

Limitations of our study were sample size being small and as our hospital was a tertiary care centre, the number of newly diagnosed young hypertensive patients who came to outpatient department would be low.

REFERENCES

1. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents.Pediatrics.2004;114(suppl 4th Report):555–576.

2. Muntner P, He J, Cutler JA, Wildman RP, Whelton PK. Trends in blood pressure among children and adolescents. JAMA. 2004;291:2107–2113.
3. Armitage P, Rose GA. The variability of measurements of casual blood pressure. A laboratory study. Clin Sci 1966;30:325-335.
4. Bevan AT, Honour AJ, Stott FW. Direct atierial pressure rccording in unrestricted man. Clin Sci. 1969;39:329-344.
5. Sokolow M, Werdegar D, KAIN HK, HINMAN AT. Relationship between level of blood pressure measured casually and by portable recorders and severity of complications in essential hypertension. Circulation. 1966 Aug;34(2):279-98.
6. Metoki H, Ohkubo T, Kikuya M, Asayama K, Obara T, Hara A, Hirose T, Hashimoto J, Totsune K, Hoshi H, Satoh H. Prognostic significance of night-time, early morning, and daytime blood pressures on the risk of cerebrovascular and cardiovascular mortality: the Ohasama Study. Journal of hypertension. 2006 Sep 1;24(9):1841-8.
7. Mancia G, Fagard R, Narkiewicz K, Redon J, Zanchetti A, Boehm M, Christiaens T, Cifkova R, De Backer G, Dominiczak A, Galderisi M. 2013 ESH/ESC guidelines for the management of arterial hypertension: the Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). Blood pressure. 2013 Aug 1;22(4):193-278.
8. Gustavsen PH, Høegholm A, Bang LE, Kristensen KS. White coat hypertension is a cardiovascular risk factor: a 10-year follow-up study. Journal of human hypertension. 2003 Dec;17(12):811.
9. Pickering TG, Shimbo D, Haas D. Ambulatory blood-pressure monitoring. New England Journal of Medicine. 2006 Jun 1;354(22):2368-74.
10. Liu M, Takahashi H, Morita Y, Maruyama S, Mizuno M, Yuzawa Y, Watanabe M, Toriyama T, Kawahara H, Matsuo S. Non-dipping is a potent predictor of cardiovascular mortality and is associated with autonomic dysfunction in haemodialysis patients. Nephrology Dialysis Transplantation. 2003 Mar 1;18(3):563-9.
11. Bendzala M, Kruzliak P, Gaspar L, Soucek M, Mrdovic I, Sabaka P, Dukat A, Gasparova I, Malan L, Takazawa K. Prognostic significance of dipping in older hypertensive patients. Blood pressure. 2015 Mar 4;24(2):103-10.
12. Timio M, Venanzi S, Lolli S, Lippi G, Verdura C, Monarca C, Guerrini E. " Non-dipper" hypertensive patients and progressive renal insufficiency: a 3-year longitudinal study. Clinical nephrology. 1995 Jun;43(6):382-7.
13. Selcoki Y, Uz B, Baybek N, Akcay A, Eryonucu B. *The effects of nocturnal dipping on cardiovascular outcomes and proteinuria in essential hypertensive patients*. Cent Eur J Med. 2008; 3: 279–286.