

STUDY ON AMBULATORY BLOOD PRESSURE MONITORING IN TYPE 2 DIABETIC PATIENTS WITH HYPERTENSION

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ABSTRACT

BACKGROUND

People with type II diabetes have altered circadian rhythm of blood pressure and are associated with increased risk of cardiovascular and renal morbidity and mortality. Our study aimed to explain the Ambulatory Blood Pressure Monitoring (ABPM) characteristics or patterns in diabetic patients with hypertension.

MATERIALS AND METHODS

70 patients with type II diabetes and hypertension were monitored with 24 hours ambulatory blood pressure changes and the data was analysed.

RESULTS

Normal dipping was observed in 38.6%, non-dipping in 47.1%, extreme dipping in 2.9% and 11.4% were reverse dippers in patients having type 2 diabetes and hypertension.

CONCLUSION

We conclude that there was a remarkably high prevalence of alterations in ABPM in patients with diabetes. Abnormalities in systolic BP during night and in circadian BP pattern could be linked with excess of BP related cardio vascular risk of diabetes.

KEYWORDS

Atrioventricular Block, Coronary Angiography, Myocardial Infarction, Pacemaker.

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BACKGROUND

Ambulatory Blood Pressure Monitoring (ABPM) is posing to be an important tool in the management of hypertension. 24 hour true BP is not perfectly represented by clinical BP monitoring. Ambulatory BP monitoring gives the opportunity to evaluate daytime, night-time and 24-h BP, night-time BP pattern, BP variability, and particular conditions such as White Coat Hypertension (WCH) and Masked Hypertension (MH)¹. ABPM helps to diagnose exactly the presence and severity of hypertension, and has been shown to have a prognostic value, greater than office measurements.¹

The ACCORD trial proved that aggressive BP control has no such benefit on cardiovascular prognosis in patients with diabetes.² since there is no fixed target individualized control of BP is becoming more important nowadays. A series of reports dealing with diabetic patients have also shown a close correlation between altered circadian pattern of BP and

diabetic complications.³ The proposed pathogenic explanation was a higher blood pressure load during the night, which is transmitted to the glomeruli because of renal afferent arteriole vasodilatation. Hypertension constitutes an important risk factor for vascular complications for patients with diabetes. Ambulatory Blood Pressure Monitoring (ABPM) provides a promising approach in estimating the exact levels of Blood Pressure (BP).³ Several studies have showed the benefits of ABPM in exploring the relationship between BP and cardiovascular events.⁴ Concepts of Masked Hyper Tension (MHT) and White-Coat Hyper Tension (WCHT) are well recognized, studies measured only by the office BP are thought to be insufficient.³ As compared to conventional clinical BP monitoring, ABPM more accurately predict cardiovascular mortality and it also detects patients with loss of normal nocturnal dipping of blood pressure.^{3,4} Type 2 diabetes patients have a two-threefold increase in cardiovascular risk and >50% of patients with type 2 diabetes are having hypertension.⁵ Non-dipping in diabetes may be due to blunted effect of sleep itself on blood pressure secondary to autonomic neuropathy.⁶

Normally, it's seen that BP is lowest in the early morning and rises as the day progress, then it goes down during the night. Usually mean BP is approximately 10-20% lower than day time value.⁴

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Blood pressure will fall at night in normotensive individuals. People undergoing this normal physiological change are described as 'Dippers'. Circadian BP patterns previously were divided into dipper (10% to 20%), extreme dipper (> 20%) and non-dipper (<10%) and reverse dipper or riser (<0%) based on the nocturnal fall of BP.⁶

A large cross-sectional study on Spanish population showed that non-dipper pattern of circadian BP was more common in patients with type 2 diabetes and the risk of cardiovascular events was also significantly higher in non dippers.⁷

MATERIALS AND METHODS

Study Population- Data was analysed from 70 randomly selected cases of type 2 diabetes mellitus with hypertension who were admitted in the Department of Medicine, KIMS, HUBLI. Written informed consent was taken, which allowed use of their data for clinical research purposes. Detailed history was taken and routine investigations were done. A simple questionnaire was completed by each patient at the time of the ABPM, and the questionnaire collected information such as the time the patient went to bed, the time the patient got up, Night-time was defined as actual sleep time using the patient’s diary. Hypertension was diagnosed as systolic BP (SBP) ≥ 140 mmHg and/or diastolic BP (DBP) ≥ 90 mmHg in office recording, or daytime (or awake) SBP ≥ 135 mmHg and/or DBP ≥ 85 mmHg or night-time (or asleep) SBP ≥ 120 mmHg and/or DBP ≥ 70 mmHg or average SBP ≥130 mmHg and/or DBP ≥80 in ABPM(EE). Exclusion criteria were made to avoid influences on the BP variations. Consequently, hypertensive patients were excluded if the patients (1) were < 18 or > 90 years old; (2) were pregnant female; (3) had night-work employment; (4) had sleep apnoea syndrome; (5) could not tolerate ABPM; (6) had history of any arrhythmia.

HbA1c value ≥ 6.5% or previous criteria for fasting plasma glucose (≥ 126 mg/dL) or 2 hour plasma glucose level of (≥ 200 mg/dL) or random plasma glucose of ≥200 with symptoms of hyperglycaemia were used for the diagnosis of diabetes mellitus.⁸

ABPM Assessment- Patients undergone 24 hrs ambulatory blood pressure monitoring by using ambulatory blood pressure monitor of Meditech Company of model ABPM-05 for all the patients of type 2 diabetes mellitus with hypertension. ABP Monitor was worn by patients for 24 hrs and blood pressure recordings were made at intervals of 20 min from 06:00 hrs to 22:00 hrs and at 30 min interval from 22:00 hrs to 06:00 hrs. ABPM recorded all these readings to give 24 hrs data of patient’s blood pressure variations.

Nocturnal BP Change and Its Patterns- The degree of nocturnal BP change (NBPC) was calculated by the following equation -

Degree of NBPC= 100x ((mean day time systolic pressure)-(mean nocturnal systolic pressure)) / (Mean day time systolic pressure).

Patients with NBPC >10% and <20% were classified as “dippers,” >20% as “extreme dippers,” >0% to <10% as “non-dippers,” and >0% as “risers.” Cut-off points are based

on the guidelines for ABPM by the Japanese circulation society as well as a previous study.⁹

Office BP Measurement

All of the BP measurements were performed by an automated sphygmomanometer after 5 minutes of rest. Three consecutive seated readings were recorded. In our analysis, office BP was the mean of these three readings.

Definitions of White Coat Hyper Tension (WHT), Masked Hyper Tension (MHT), and Persistent Hypertension (PHN) and Controlled Hyper Tension (CHT): We classified hypertension using thresholds of office BP of ≥140/90 mmHg and 24-hour average BP of ≥ 130/80 mmHg. WHT is the office BP ≥140/90 mmHg and 24-hour average BP of <130/80 mmHg. MHT is the office BP of <140/90 mmHg and 24-hour average BP ≥130/80 mmHg. Persistent Hyper Tension (PHT) is the office BP ≥140/90 mmHg and 24-hour average BP ≥130/80 mmHg. Controlled Hyper Tension (CHT) office BP <140/90 mmHg and 24-hour average BP <130/80.

Statistical Analysis

Data was entered into Microsoft excel data sheet and was analysed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-Square Test was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. ANOVA (Analysis of Variance) was the test of significance to identify the mean difference between more than two groups for quantitative data.

Graphical Representation of Data- MS Excel and MS

word was used to obtain various types of graphs such as bar diagram. P value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

RESULTS

After analysing data in 70 patients with type 2 diabetes and hypertension, mean age of subjects in the study was 51.5 ± 13.7 yrs. Majority were male about 67.1%. Mean duration of hypertension was 6.3 ± 2.8 yrs. Mean duration of diabetes was 6.4 ±2.5 yrs. The pattern of dipping of blood pressure was observed as – non-dippers were 47.1%, normal dippers were 38.6%, reverse dippers were 11.4% and 2.9% of the patients were extreme dippers (Table 2). Among the 70 patients with type 2 diabetes and hypertension, type of hypertension was observed as-Controlled Hyper Tension (CHT) were 22.9%, Masked Hypertension (MHT) were 31.4%, Persistent Hyper Tension (PHT) were 35.7%, White coat Hypertension (WHT) were 10%. (Table 3).

		Mean	SD
Age		51.5	13.7
Gender	Female	23	32.9%
	Male	47	67.1%
Duration of HTN		6.3	2.8
Duration of DM		6.4	2.5

FBS	126.9	14.8
PPBS	232.3	25.3
HbA1c	7.9	.9
Serum Cholesterol	169.6	35.7
VLDL	37.0	4.8
LDL	128.5	15.0
HDL	42.1	2.6
STG	157.9	15.5
UACR	171.5	92.4
ABPM SBP	138.0	19.8
ABPM DBP	79.6	13.6

Table 1. Profile of Diabetic Subjects in the Study

Mean age of subjects in the study was 51.5 ± 13.7 years, duration of HTN was 6.3 ± 2.8, mean duration of DM was 6.4 ± 2.5.

		Count	Percentage
Type of HTN	Controlled HTN	16	22.9%
	Masked HTN	22	31.4%
	Persistent HTN	25	35.7%
	White coat HTN	7	10.0%

Table 2. Type of HTN

22.9% had controlled HTN, 31.4% had masked HTN, 35.7% had persistent HTN and 10% had white coat HTN.

		Count	Percentage
NBPC	<0 Reverse dippers	8	11.4%
	0 to 9 Non dippers	33	47.1%
	10 to 20 Dippers	27	38.6%
	>20 Extreme dippers	2	2.9%

Table 3. Showing Pattern of Diurnal Index in the Study Population

In the study 11.4% were reverse dippers, 47.1% were non dippers, 38.6% were dippers and 2.9% were extreme dippers.

		Count	Percentage
NBPC	<0 Reverse dippers	8	11.4%
	0 to 9 Non dippers	33	47.1%
	10 to 20 Dippers	27	38.6%
	>20 Extreme dippers	2	2.9%

Table 4. Showing Pattern of Diurnal Index in the Study Population

In the study 11.4% were reverse dippers, 47.1% were non dippers, 38.6% were dippers and 2.9% were extreme dippers.

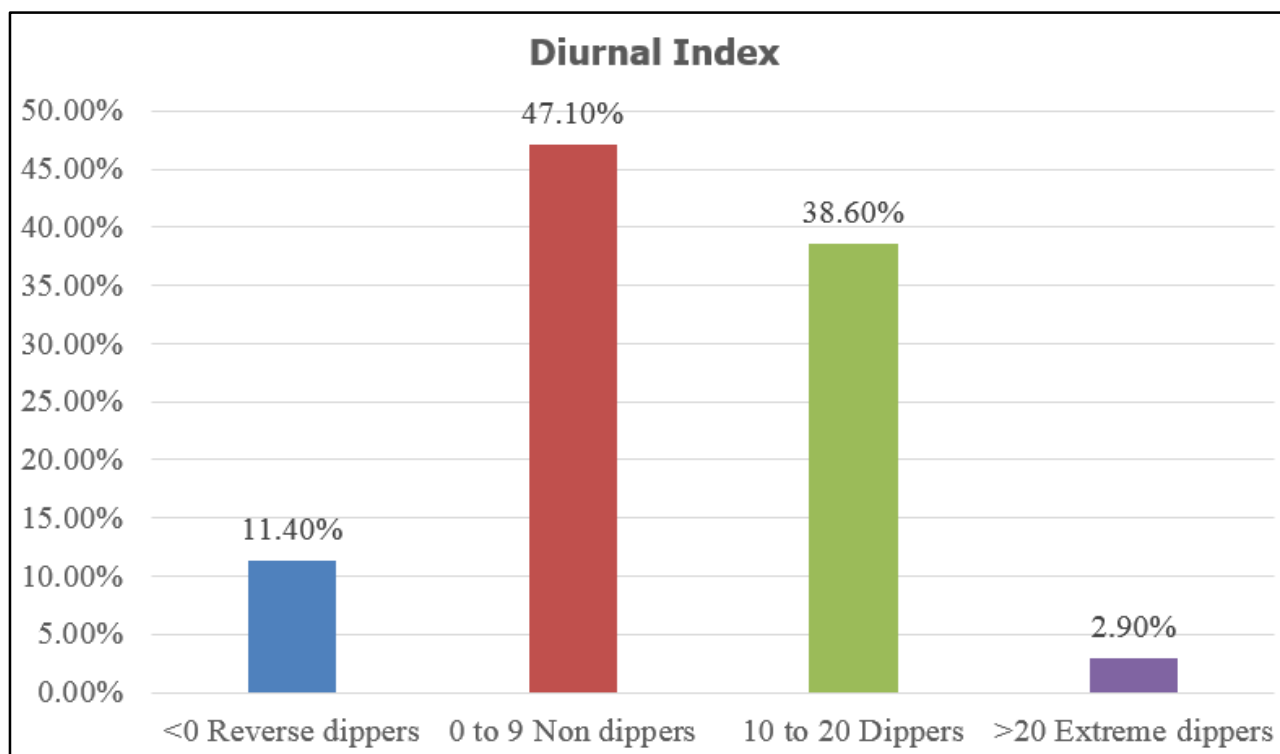


Figure 1. Bar Diagram Showing Pattern of Diurnal Index in the Study Population

DISCUSSION

This study observed that prevalence of altered circadian pattern of BP in type 2 diabetes with HTN subjects significantly present. > 50% of these subjects had their day time BP uncontrolled and two of three patients had nocturnal

hypertension and /or a blunted circadian pattern of BP. On the other hand 10% of people had white coat effect.

Based on office BP 45.7% were considered as hypertensives that includes both the persistent HTN and White coat effect. But after doing ABPM about 67.1% were

diagnosed as hypertensive and it excludes white coat effect people and includes masked HTN.

According to the Gorostidi et al prevalence of non-dipper were more common in diabetic patients with hypertension at around 64.2% compared to non-diabetics (51.6%), 33% of diabetics were white coat HTN, about 52% had day BP \geq 135/85 mmHg and 2 of 3 cases had night HTN.⁹

A study by Ashok Duggal in 100 patients with type 2 diabetes and hypertension showed that non dippers were 46%, normal dippers were 45%, reverse dippers were 3% and extreme dippers were 6%.¹⁰

Cuspidi et al patient with diabetes non dipping pattern detected by a single ABPM study could be more reliable than non-diabetic patients.¹¹

A.de la Sierra et al stated that in diabetic patients prevalence of an abnormal BP rhythm is frequently observed.¹²

White coat HTN has been considered a low risk factor for cardio vascular events but when it is associated with diabetes white coat HTN acts as a risk factor .Prevalence of white coat HTN in other studies dealing with diabetics ranged between 14 and 51%.

Eguchi et al. Reported a prevalence of 26% of WCH (clinical hypertension and 24-h BP < 135/ 80 mmHg) among their patients with T2DM. Moreover, they reported that subjects with WCH and T2DM had higher prevalence of multiple silent cerebral infarcts than those with WCH alone (P < 0.05).

Recent article has reported that type 2 diabetes with a riser profile of BP showed 88% mortality during a follow up of 9 years and mortality in the non-risers was 45%

Kramer et al. Reported a prevalence of 23% of WCH (clinical hypertension and daytime BP < 135/85 mmHg) in T2DM. When compared with normotensive patients, those with WCH had more than two-fold higher risk of diabetic nephropathy and retinopathy.¹³

Recently, Eguchi et al. studied the prevalence of cardiovascular events in sustained and white coat hypertensive patients with and without T2DM during 4 years of follow-up. Prevalence of WCH in T2DM was about 20%.

Leitao et al conducted a study on 135 type 2 diabetes they got prevalence of Masked HTN was 30%. In IDACO, masked HTN prevalence was 29.3%.¹⁴

CONCLUSION

Diabetic patients with hypertension showed a remarkably greater prevalence of alterations in ABPM. Abnormalities in systolic BP, especially during the night, and in circadian BP pattern could be linked with the excess of BP-related cardio renal risk of diabetes. These observations support the proposal for a wider use of ABPM in diabetic patients.

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