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Ambulatory Daytime And Nighttime Heart Rate Is Significantly Higher In Nondipper Hypertensive Patients

Ambulatuvar Gündüz ve Gece Kalp Hızı Nondipper Hipertansif Hastalarda Anlamlı Derecede Yüksektir

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ABSTRACT

Objectives

Nondipping status; probably a result of sympathetic hyperacitivity; is clinically associated with poor prognosis. In this study we aimed to evaluate the variation of daytime and nighttime heart rate among dipper and nondipper patients probably due to sympathetic hyperactivity.

Material and Method

116 patients were enrolled and performed 24 hour ambulatory blood pressure monitoring. 24-hour daytime and nighttime systolic and diastolic blood pressures and heart rates were compared between the dipper and non dipper hypertensive patients. Statistical analysis was performed by Independent Samples t test using SPSS 11.0 for Windows.

Results

Daytime heart rates were higher in nondipper patients than dipper patients (78,3±9 vs 75,2±9, p=0.1>0.05), but the difference was not statistically significant. Also nighttime heart rates were significantly higher in non dipper patients (65,9±8,7 vs 61,7±7,8, p=0.02<0.05). Nighttime heart rate dipping is significantly lower in nondipper patients (%14.2±6.1 vs %17.8±5.9 p<0.05).

Conclusion

Increased heart rates of daytime and nighttime period in nondipper patients are clinical finding of sympathetic hyperactivity which was accounted for nondipping. Since nondipping status is closely associated increased risk for cardiovascular events, effective treatment of nondipper patients and modifications in drug therapy may reduce cardiovascular morbidity and mortality.

Key Words: *Hypertension, nondipping, heart rate, ambulatory*

Amaç
Nondipping durumu olasılıkla sempatik hiperaktivitenin bir sonucu olup klinik olarak kötü bir prognoz ile ilişkilidir. Bu çalışmada nondipper ve dipper hipertansif hastalarda gece ve gündüz kalp hızı değişimini incelemeyi amaçladık.

Materyal ve Metod
116 hasta çalışmaya alındı ve 24 saatlik ambulatuvar kan basıncı monitorizasyonu yapıldı. 24 saatlik gündüz ve gece sistolik ve diyastolik kan basınçları ve kalp hızları dipper ve non dipper hastalar arasında karşılaştırıldı. İstatistiki analizler Independent Samples t test ile SPSS 11.0 Windows paket programı kullanılarak yapıldı.

Bulgular
Gündüz kalp hızı nondipper hastalarda dipper hastalara göre yüksek izlendi (78,3±9 ile 75,2±9, p=0.1>0.05) ancak istatistiki olarak anlamlı değildi. Gece kalp hızı ise nondipper hastalarda anlamlı derecede yüksek izlendi (65,9±8,7 ile 61,7±7,8, p=0.02<0.05). Gece kalp hızı düşüşü nondipper hastalarda anlamlı derecede düşük izlendi (%14,2±6,1 ile %17,8±5,9 p<0.05).

Sonuç
Nondipper hastalarda gündüz ve gece kalp hızı yüksekliği nondipping durumundan da sorumlu tutulan sempatik hiperaktivitenin bir klinik bulgusudur. Nondipping kardyovasküler olay artışı ile ilişkili olduğundan dolayı nondipper hastaların etkin tedavisi ve ilaç tedavisi modifikasyonu kardiyovasküler mortalite ve morbiditeyi azaltabilir.

Anahtar Kelimeler: *Hipertansiyon, nondipping, kalp hızı, ambulatuvar*

INTRODUCTION

Circadian rhythm of blood pressure is abnormally changed in non dipper hypertensive patients. Blunted fall of nocturnal blood pressure is the characteristic feature of those patients (1). Nondipping status is closely associated with a higher incidence of cardiovascular events and target organ damages, and also a poor prognosis (2). 24-hour ambulatory blood pressure monitoring is an effective way of evaluation of diurnal rhythm of blood pressure and heart rate variability in patients with hypertension. Additionally those data were more predictive of cardiovascular risk (3).

Non dipping status is probably a consequence of multiple pathophysiological abnormalities. Autonomic dysfunction, insulin resistance, and obesity etc. are the abnormalities associated with nondipping (4,5). Enhanced sympathetic activity and decreased parasympathetic responses may be additional abnormalities accounted for nondipping form of hypertension (6). It could clinically be manifested by increased heart rate or tachycardia. Deranged autonomic tone and increased heart rate promotes atherosclerosis by inducing endothelial injury and shear stress (7).

In this study we aimed to evaluate 24-hour, daytime, and nighttime heart rate of hypertensive patients and its probable relationship with nondipping status. Normally it was expected sympathetic withdrawal and blunting in blood pressure and heart rate during sleep. Heart rate is a significant finding in clinical evaluation, since increased heart rates were found to be a strong independent predictor of all cause mortality (8).

MATERIAL AND METHOD

Totally, one hundred and sixteen hypertensive patients were enrolled to the study. Patients with anemia, coronary artery disease, diabetes, and chronic renal failure, obesity, were excluded from the study. Patients on beta blocker therapy were excluded. Patients voluntarily underwent 24 hour ambulatory blood pressure monitoring. Patients were informed and signed written informed consent form.

All subjects were instructed to go on their routine daily activities and not to perform extreme workings during 24-hour ambulatory blood pressure monitoring. An appropriate sized cuff was placed around the nondominant arm. Measurement of blood pressure at 15-minute intervals throughout the 24-hour study period was planned. 80 to 90 pairs of systolic and diastolic blood pressure recordings with its simultaneous time data were documented and transferred to computer. All subjects were instructed to rest or sleep between 10:00 PM and 06:00 AM (nighttime) and to maintain their usual activity at 06:00 AM and 10:00 PM. Subjects working at night shift were excluded. Dipping condition was determined by the 10% decrease of blood pressures in the night measurements compared to day measurements. Averages of 24-hour, daytime and nighttime systolic, and diastolic blood pressures, and heart rates were calculated from the 24 hour measurements. Statistical analysis was performed by Independent Samples t test using SPSS 11.0 for Windows.

RESULTS

Demographic features of patients (age, BMI) were not different between groups (Table 1). Heart rates of non dipper patients were slightly higher than the dipper patients at daytime period (78,3±9 vs 75,2±9, p=0.1>0.05), but the difference was not statistically significant. Also heart rates measured at nighttime period was significantly higher in non dipper patients compared to dipper patients (65,9±8,7 vs 61,7±7,8, p=0.02<0.05). Daytime systolic and diastolic blood pressures were higher in nondipper patients but the difference was not statistically significant. However nighttime systolic and diastolic blood pressures were significantly higher in nondipper patients when compared to dipper patients (Table 1). When we evaluated the reduction of heart rate at nighttime compared to daytime, we observed that reduction in heart rate at nighttime was significantly lower in nondipper patients (%14.2±6.1 vs %17.8±5.9 p<0.05).

DISCUSSION

Circadian pattern of blood pressure is normally nocturnal fall of blood pressure as 10-20%. But fall in blood pressure was less than <10% in nondipper patients. Failure to decrease blood pressure at nighttime was resulted due to mal-supression of sympathetic activity and/or inappropriate central blood volume load (9). Variation between daytime and nighttime heart rates could be observed among dipper and nondipper hypertensives due to those abnormalities in autonomic functions. Non dipping status is found to be closely associated with cerebrovascular and cardiovascular events (10), so abnormality of heart rate variation which was observed in non dipper hypertensive patients may be predictor of cardiovascular morbiditiy and mortality. Thus we aimed to evaluate the heart rate variation in hypertensive patients by 24-hour ambulatory blood pressure monitoring.

We observed that daytime systolic and diastolic blood pressures were higher in non dipper hypertensive patients, but not statistically significant (respectively, 138,6±15,8 vs 134,0±15,9, 86,0±11,6 vs 83,1±9,9, p>0.05).

However nighttime systolic and diastolic blood pressures were significantly higher in when we compared the reduction in heart rate between dipper and nondipper hypertensives, we observed that heart

Table 1: *Comparison of 24-hour daytime, and nighttime systolic, and diastolic blood pressure and heart rate between dipper and nondipper hypertensive patients*

	Nondipper patients (n=31)	Dipper patients (n=85)	p*
Age (year)	56,6±6,3	60,5±4,2	>0.05
BMI (kg/m2)	27,5±1,1	28,1±1,7	>0.05
Daytime heart rate (bpm)	78,3±9,0	75,2±9,2	>0.05
Daytime SBP (mm Hg)	138,6±15,8	134,0±15,9	>0.05
Daytime DBP (mm Hg)	86,0±11,6	83,1±9,9	>0.05
Nighttime heart rate (bpm)	65,9±8,7	61,7±7,8	0.01<0.05
Nighttime SBP (mm Hg)	131,6±17,2	118,5±13,1	0.01<0.05
Nighttime DBP (mm Hg)	80,8±11,7	70,8±8.2	0.01<0.05
Reduction in heart rate (%)	14.2±6.1 %	17.8±5.9 %	0.02<0.05

*Independent Samples t test; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; bpm, beat per minute

rate was reduced in nondipper less than dipper patients (14.2±6.1 % vs 17.8±5.9 %, p=0.02). Kotsis et al. reported that obesity is related with the nondipping status in obese hypertensives (12). But we excluded the obese patients out of the study in order to rule out the impact of obesity on the data. Our study population was composed of relatively older patients. However Palatini and Julius reported that the age affected clinic heart rate only to a slight extent, possibly more in women than in men (13). So non dipper patients (respectively 131,6±17,2, 118,5±13,1, 80,8±11,7 vs 70,8±8.2, p=00.01).

we ignored the possible effects of age on our data. From the data we can propose that sympathetic overdrive should be predominant throughout the whole day, if sympathetic overdrive is one of those accounted mechanisms for nondipping. Beacuse all of the measurements of daytime and nighttime blood pressures were higher in nondipper patients when compared to dipper patients. Also we observed that daytime and nighttime heart rates were significantly higher in nondipper patients. This finding may be a clinically manifestation of sympathetic overdrive which lasts throughout the whole day (11). Increased heart rate and sympathetic overactivity promotes the atherosclerotic process via inducing shear stress on endothelial functions (7).

Heart rate was also found to predict cardiovascular and cerebrovascular events, and all cause mortality (14). Non dipping status in patients with hypertension was found to be related more renal morphological changes and long term hyperfiltration in normoalbuminuric adolescents and young adults with short duration of type 1 diabetes (15). Additionally it was reported that nondipping status may be an early predictor of later nephropathy (15).

We can suggest that blunted heart rate dipping in those patients may be an additional predictor of those complications as nondipping status is. Modifications guided by ambulatory blood pressure monitoring in antihypertensive treatment may provide cardiovascular benefits. Lack

of blood pressure control is a common problem among hypertensive patients. Thus combination therapy is recommended for a better blood pressure control. Mancia et al. reported that improvement of left ventricular hypertrophy could be provided by the changes in antihypertensive treatment guided by ambulatory blood pressure monitoring (16). Application of antihypertensive drugs in two different times such as in the morning and evening of the day may regulate abnormal surge in blood pressure during the nighttime and the morning. Minutolo et al. reported that switching one hypertensive dose from morning to night could limit nondipping status and also its complications (17). Since morning surge in blood pressure may be associated with hypertensive target organ damage and subsequent cardiovascular risk in hypertensive patients. Kario et al. suggested that strict blood pressure control and antihypertensive medication may achieve more effective prevention of cardiovascular events in hypertensive patients especially the nondippers (18).

Heart rate may be a novel goal in the management of hypertension. Because 24-hour heart rate and blood pressures are independent and additive predictives of left ventricular mass in untreated hypertensive individuals (19). Recently, Custodis et al. reported that selective heart rate reduction with ivabradine decreased markers of vascular oxidative stress, improved function, and reduced atherosclerotic plaque formation in apolipoprotein E-deficient mice (20). Neumann et al. administered eprosartan and moxonidine in order to reduce sympathetic hyperactivity and suggested that those combinations could potentially decreaed cardiovascular morbidity and mortality and also proteinuria (21,22).

Bankir et al. suggested that an abnormal variation in sodium and water excretion between daytime and nighttime period may be contributing factors in nondipper patients. Thus they proposed that the addition of diuretic may potentiate thenocturnal fall in blood pressure (23).

Kalaitzidis and Bakris suggested that preference of vasodilating beta blockers in patients with chronic kidney disease would improve cardiovascular outcomes via abolishing sympathetic overactivity in chronic kidney disease (24). Yilmaz et al. reported that nebivolol was associated with improvement of sleep, but the metoprolol was associated with worsening of sleep characteristics (25).

CONCLUSION

Blunted dipping of nocturnal heart rate is closely associated with non dipping status of hypertensive patients. Consequently; non dipping status and increased heart rate are the important clinical findings which are associated with sympathetic hyperactivity. Those clinical features are the indicators for poor prognosis and increased cardiovascular morbidity and mortality. Effective treatment and management of non dipper hypertensive patients guided with the pathophysiological mechanisms of nondipping status is particularly important to prevent and reduce cardiovascular events.

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