COMPARISON OF DIPPING/NON-DIPPING PATTERN WITH ATHEROGENIC DYSLIPIDEMIA IN GRADE 1 OBESE HYPERTENSIVE PATIENTS

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ABSTRACT

Introduction: *Obesity, hypertension and dyslipidemia are increasing in prevalence worldwide, and are closely linked to cardiovascular diseases. Non-dipper hypertension pattern is associated with more severe target organ damage and cardiovascular events. Atherogenic dyslipidemia has evidence to be an independent risk factor for cardiovascular diseases. There is still not a study made comparing atherogenic dyslipidemia in hypertension patterns. In this study we aimed to compare the prevalence of atherogenic dyslipidemia and dipper, non-dipper hypertension in patients with grade 1 obesity.*

Materials and methods*: A total of 272 patients (female n:180, 68.2%) with grade 1 obesity followed-up for essential hypertension and who did not have a history of hypolipidemic drug use were included in the study. Patients had atherogenic dyslipidemia, high triglyceride levels, high-density lipoprotein levels and low-density lipoprotein levels were high-normal.*

Results*: Atherogenic dyslipidemia prevalence was higher in non-dipper hypertension group (n: 84, 67.0%) than patients with dipper hypertension group (n:28, 18.9%) which was also statistically significant (p=0.03).*

Conclusion*: In our study, the prevalence of hypertension in obese patients was found to be quite high. It is established in our study that atherogenic dyslipidemia may be a factor playing role in non-dipper hypertension patients with grade 1 obesity. Effective treatment of atherogenic dyslipidemia may result in the improvement of non-dipping status. High-risk patients should be evaluated in detail from the cardiovascular end point of view.*

Keywords: *Hypertension, Dyslipidemia, Obesity, Non-dipper hypertension.*

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Introduction

The circadian rhythm has many roles in human body, and is the main factor acting in blood pressure (BP) reduction at nighttime compared to daytime values[1, 2]. This reduction does not seem in non-dipper hypertension (NDH) pattern which is associated with more severe target organ damage and cardiovascular events[3]. Ambulatory BP monitoring (ABPM) is an essential tool for diagnosis of hypertension[4]. Some studies show that ABPM is superior to BP measurements in the clinic[5]. There are some studies comparing cardiovascular risks of dipper hypertension (DH) and NDH; however, there is not yet a laboratory parameter that may be used to distinguish DH and NDH.

The Framingham Heart Study, the Multiple Risk Factor Intervention Trial (MRFIT), and the Lipid Research Clinics (LRC) trial found a direct relationship between levels of low-density lipoprotein (LDL) cholesterol (C) and the rate of new-onset coronary heart disease (CHD) in patients without previously known CHD[6-8]. By LDL- C, the targeted is to treat CHD; however, recent studies show that there is a critical residual CHD risk after optimizing LDL- C[9,10]. Austin et al. first described the term "atherogenic dyslipidemia" (AD) as a lipid profile characterized with high triglyceride, low high-density lipoprotein (HDL) C and high levels of small dense LDL particles[11]. Each component of AD has evidence to be an independent risk factor for cardiovascular diseases. There is still not a study made comparing AD in DH and NDH.

Obesity is a general public health problem due to its association with several diseases in numerous industrialized countries. Obesity causes cardiovascular and chronic renal diseases through several mechanisms including hypertension, hyperglycemia, dyslipidemia and atherosclerosis. Body mass index (BMI) calculation, waist circumference, and waist/hip ratio are the common measures of the degree of body fat used in routine clinical practice. According to WHO (World Health Organization) obesity may be classified into three group[12]. WHO obesity classification system was shown in Table 1. BMI between 30-34.9 is considered as grade 1 obesity. The majority of obese population is grade 1.

Classification	BMI (kg/m^2)
Normal range	18.5-24.9
Overweight	25.0-29.9
Grade 1 obese	30.0-34.9
Grade 2 obese	35.0-39.9
Grade 3 obese	≥40.0

Table 1: Obesity classification of WHO.
BMI: body mass index

Atherogenic dyslipidemia and NDH is very common in obese population. In this study we aimed to compare AD prevalence in grade 1 obese patients with DH and NDH.

Materials and methods

Patients and laboratory measurements

A total of 272 patients (180 female, 68.2%) with grade 1 obesity according to WHO followed-up for essential hypertension who did not have a history of hypolipidemic drug use were included in this study. Patients were grouped as DH (nocturnal decrease in mean BP of at least 10% when compared to daytime mean BP) and NDH (nocturnal decrease less than 10% or lack of nocturnal decrease). Informed consent forms were obtained from all of the included patients.

Patients diagnosed with type 2 diabetes mellitus and had a history of hypolipidemic drug use were excluded. ABPM was made with A&D TM-2430 Ambulatory Blood Pressure Monitor, Japan device. Measurements were made per 15 min during daytime and per 30 min at nighttime.

The demographic data and BMI of all patients were recorded. Serum total C, triglyceride, HDL-C levels were measured with enzymatic colorimetric method in biochemistry analyzer Beckman Coulter AU 2700 plus. LDL cholesterol levels were calculated using Friedwald formula (LDL = TC-[(TG / 5) + HDL]). Patients who had AD whom triglyceride levels were high, HD-C levels were low and LDL-C levels were high-normal.

Statistical analysis

Mean value ± SD was used for continuous variables and percentages were used for categorical variables. Chi-square test used for comparing categorical variables. Compliance with the normal distribution of numerical data was checked with Kolmogorov-Smirnov test. Mann Whitney U test was used for comparing age, total C, LDL-C, triglyceride, HDL-C and BMI between two groups. $p<0,05$ was considered as statistically significant. All statistical analyzes were made in SPSS 17.0 (SPSS Inc., Chicago, IL, USA).

Results

Ninety-two patients were male, 180 patients were female (36.8% and 63.2%, respectively). 148 patients (54.4%) had DH (96 female, 64.7%), whereas 124 patients (45.6%) fell into NDH group (84 female, 67.7%). In DH group, mean age and BMI were 45.6 ± 8.5 years and 32.2 ± 3.1 kg/m^{2,} respectively; in NDH group mean age and BMI were 45.8 ± 7.3 years and 33.3 ± 2.8 kg/m^2, respectively. DH and NDH groups were comparable regarding age (p=0.3), gender (p=0.6) and BMI (p=0.8). Patients' age, gender and BMI values are displayed in Table 2.

	DH	NDH	p
Male n (%)	52 (19%)	40 (14.7%)	
Female n (%)	96 (34.5%)	84 (30.9%)	
Age (year)	45.0±8.5	45.8±7.3	0.3
BMI (kg/m^2)	32.2±3.1	33.3±2.8	0.8
Total-C (mg/dl)	181.5±6.3	193.3±7.7	0.04
LDL-C (mg/dl)	110.7±8.1	126.9±7.8	0.04
Triglyceride (mg/dl)	143.7±8.5	162.6±9.1	0.03
HDL-C (mg/dl)	40.2±4.9	35.2±5.2	0.07
AD n (%)	28 (18.9%)	84 (67.7%)	0.03

Table 2: Demographic, lipid parameters, and atherogenic dyslipidemia prevelance of patients according to groups.
AD: atherogenic dyslipidemia, DH: dipper hypertension, NDH: non-dipper hypertension, BMI: body mass index, C: cholesterol, LDL: low density lipoprotein; HDL: high density lipoprotein

The mean total C was found 181.5 ± 6.3 mg/dl, HDL-C was 40.2 ± 4.9 mg/dl, triglyceride was 143.7 ± 8.5, and LDL-C was 110.7 ± 8.1 mg/dl in DH group. In NDH group the mean total C was 193.3 ± 7.7 mg/dl, HDL-C was 35.2 ± 5.2 mg/dl, LDL-C was 126.9 ± 7.8 and triglyceride was 162.6 ± 9.1 mg/dl. There was no statistically significant difference in two groups when they compared respect to total C (p:0.04), LDL-C (p:0.04) and triglyceride levels (p:0.03).

There was no significant difference in HDL-C levels between groups (p:0.07). A total of 112 patients had AD in whom only 28 had DH. The AD prevalence was higher in NDH group than patients with DH, which was also statistically significant (p=0.03). The comparisons of groups respect to total C, LDL-C, triglyceride, HDL-C levels and AD are given in Table 2.

Discussion

The prevalence of obesity is increasing all over the world. Treatment management of obese and hypertensive patients has not been fully clarified.

Hales et al. showed that obesity was a critical health problem in the United States between 2015-2016, and they established that almost 39.8 % of people were obese[13]. In our country it was shown that 22% of the adult population had obesity in Turkish Diabetes Epidemiology Study (TURDEP-2)[14]. There are some studies showing that NDH causes more end-organ damage than DH[3]. Constant high BP may be responsible for this situation however, there may be other factors. Detection and treatment of other factors causing NDH may provide a reduction in end-organ damage that is caused by NDH.

Treatment of each CHD risk factor provides a significant risk reduction for cardiovascular events[15,16]. AD is one of the well-known risk factors for CHD[11,17]. Each component of AD has evidence to be an independent risk factor for CHD. National Cholesterol Education Program (NCEP) has reported that AD commonly occurred in patients with premature coronary heart disease in Adult Treatment Panel 3 and concluded that drugs modifying AD provide a moderate risk reduction in CHD[17].

There are several studies comparing lipid levels in patients with DH and NDH. Tartan Z. et al. analyzed lipid parameters regarding DH and NDH; however, they did not find a significant difference between groups[18]. In our study, patients with NDH appeared to have a higher AD prevalence than patients with DH.

Ayman M. et al. investigated whether metabolic syndrome was a predictor of NDH and in this study there was significant difference in triglyceride levels of patients with DH and NHD[19]. They did not establish significant differences between HDL-C and LDL-C in patients with DH and NDH. In our study, we determined significant differences between the two groups when we compared them with respect to total C, LDL-C and triglyceride levels.

Sezer S. et al. showed that total C, LDL-C and triglyceride levels were significantly higher in non-obese renal transplant patients with NDH than DH[20]. In our study, we determined statistically significant differences in total C, LDL-C, and triglyceride levels between patients with DH and NDH. Both intrinsic and extrinsic factors such as neurohormonal factors, nutritional factors and smoking may play role in pathophysiological mechanisms of NDH.

Among obese patients, the highest rate belongs to grade 1 obese patients. Particularly, when the fact that overweight patients will also be included in this group is considered, these two groups constitute nearly half of obese patients. Although there are a great number of studies in this field, which show the relation between obesity and AD in the literature, there are not many studies that were conducted particularly on grade 1 obese patients. Although there are several studies, which show the relation between the dipping effect in hypertension and cardiovascular disease in patients who have metabolic syndromes, no studies were detected that investigated this relation in grade 1 obese patients.

Although our patient group was similar to the population who had metabolic syndromes, it had different features. It is already well-known that correcting the AD and obesity with changes in lifestyle or with pharmacological methods reduces cardiovascular risk. Hypertension, obesity and dyslipidemia are the frequent diseases that usually co-exist and affect each other negatively. Although many clinical studies investigated the relations and mechanisms among these, many steps of etiopathogenesis have not yet been explained.

In recent years, several studies published showing relationship between AD and insulin resistance.

Our study showed that both AD and NDH increased in grade 1 obese patients. Our study is important because of showing the relationship between AD and NDH although there are some limitations as the small number of patients and the lack of antihypertensive drugs data. The relation among the dipping effect, the different effects of lipid components and obesity are truly complex. Particularly, evaluation and enlightening this relation in early grade obesity is important in determining the treatment approaches to be applied to this group.

Conclusions

The prevalence of hypertension is quite high in obese patients. Our study is important in terms of demonstrating the relationship between AD and non-dipping pattern in hypertensive patients with grade 1 obesity.

While hypertension treatment is planned in obese patients, AD and diping/nondiping pattern should be investigated. Efforts to correct AD and obesity may cause improvement in nondipper pattern of hypertensive patients. High-risk patients should be evaluated in detail from the cardiovascular end point of view. Explaining whether the treatment of AD and obesity will improve the dipping pattern with a prospective study in the future will eliminate a great number of questions in this field.

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