RESEARCH ARTICLE

Comparison of Hematological and Biochemical Parameters and Cardiovascular Risk Scores in Patients Applying to the Obesity Outpatient Clinic

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ABSTRACT

Objective: The aim of this study was to compare hematological and biochemical parameters and cardiovascular risk scoring in patients admitted to the obesity outpatient clinic.

Methods: In this descriptive cross-sectional study, data of the patients who admitted to the Obesity Outpatient Clinic of Duzce University Research and Application Hospital between 2017 and 2018 were evaluated retrospectively. Age, gender, smoking status, presence of Diabetes Mellitus (DM), and body mass index (BMI) were recorded and the cardiovascular risk of the patients was calculated by using the scoring system of the European Society of Cardiology (ESC) and Turkish Society of Cardiology (TSC).

Results: A total of 631 participants were included in the study. The mean age was 38.9±12.1 (min=21, max=65) and 75.1% of the patients were female and 24.9% were male. It was observed that 19.2% of the patients were smokers, 4.6% had DM and 36.9% had insulin resistance. When the patients were evaluated according to the BMI scores, it was found that 3.3% of them were underweight, 7.3% were normal weight, 22.5% were overweight and 66.9% were obese. According to TSC risk scoring system, 51.4% of the patients were in low risk, 20.5% were in medium risk and 28.1% were in high risk category. According to the ESC risk scoring system, 83.5% of the patients were in low risk, 10.9% were in medium risk and 5.5% were in high risk category. According to both risk scoring systems, there were significant differences between the risk groups in terms of age, gender, BMI, and presence of DM (p<0.001). When evaluated according to the TSC risk score, it was seen that the patients in the high-risk category had a lower platelet/lymphocyte ratio and a higher total cholesterol/HDL ratio. According to both risk scoring systems, no correlation was found between cardiovascular risk and RDW, MPV, leukocyte count, and NLR(Neutrophil-Lymphocyte ratio).

Conclusions: Conducting a cardiovascular risk assessment for patients who admit to primary health care services for obesity counseling is important. A cardiovascular risk assessment conducted at admission may help some precautions to be taken earlier. There is a need for more studies to determine easily accessible parameters that can predict cardiovascular risk.

Keywords: Obesity, BMI, NLR, PLR, Cardiovascular Risk Scores, Hematological Parameters.

Obezite Polikliniğine Başvuran Hastalarda Hematoljik ve Biyokimyasal Parametrelerle Kardiyovasküler Risk Skorlarının Karşılaştırılması

ÖZET

Amaç: Bu çalışmada, obezite polikliniğine başvuran hastalarda; hematolojik ve biyokimyasal parametreler ile kardiyovasküler risk skorlamasının karşılaştırmalı değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Tanımlayıcı-kesitsel olarak planlanan bu araştırmada, Düzce Üniversitesi Araştırma ve Uygulama Hastanesinin Obezite Polikliniğine 2017-2018 yılları arasında başvuran hastaların, dosya verileri retrospektif olarak değerlendirildi. Hastaların yaş, cinsiyet, sigara kullanımları, DM tanılarının varlığı, BKİ değerleri kaydedildi; kardiyovasküler risk faktörleri Avrupa ve Türkiye Kardiyoloji Dernekleri risk skorlamasına göre değerlendirildi.

Bulgular: Çalışmaya %75,1'i kadın, %24,9'u erkek, 631 katılımcı dahil edilmiştir. Yaş ortalaması 38,9±12,1 (min=21-maks=65) olarak bulunmuştur. Hastaların %19,2'sinin sigara kullandığı, %4,6'sında DM ve %36,9'unda insülin direnci olduğu görülmüştür. Katılımcıların %3,3'ü zayıf, %7,3'ü normal kilolu, %22,5'i fazla kilolu ve %66,9'u obezdir. Türkiye Kardiyoloji Derneği risk skorlamasına göre hastaların %51,4'i düşük , %20,5'i orta ve %28,1'i yüksek risklidir. Avrupa Kardiyoloji Derneği risk skorlamasına göre ise hastaların %83,5'i düşük, %10,9'u orta ve %5,5'i yüksek risklidir. Her iki risk skorlamasına göre risk grupları arasında yaş, cinsiyet, beden kitle indeksi ve DM varlığı açısından anlamlı farklılık görüldü (p<0,001). Türkiye Kardiyoloji Derneği risk skorlamasına göre; yüksek risk grubunda olanların daha düşük trombosit/lenfosit oranına ve daha yüksek total kolesterol/HDL oranına sahip olduğu görüldü. Her iki skorda da kardiyovasküler risk ile RDW, MPV, lökosit sayısı, nötrofil/lenfosit oranı değerlerinde ilişki saptanmadı.

Sonuç: Birinci basamak sağlık hizmetlerine obezite danışmanlığı için başvuran hastalara risk değerlendirmesi yapılması önemlidir. Yapılan kardiyovasküler risk değerlendirmesi ile bazı önlemlerin erkenden alınması sağlanabilir. Riskin erken saptanması amacıyla klinisyenlerin kolay ulaşabilecekleri parametreleri ortaya çıkaracak daha çok çalışmaya ihtiyaç vardır.

Anahtar Kelimeler: Obezite, BKI, NLR, PLR, Kardiyovasküler Risk Skorları, Hematolojik Parametreler.

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INTRODUCTION

The main task of family physicians is first of all primary prevention and to help the diagnosis, treatment, follow-up and palliative care process of the diseases (1). Obesity is one of the most common diseases in the society with an increasing prevalence, can be prevented with primary prevention, which is one of the main tasks of family medicine. According to the 2016 data of the World Health Organization, the prevalence of obesity has tripled in the last 40 years. The prevalence of obesity constitutes 13% of the adult population (2). The potential diseases that obesity can cause include cardiovascular diseases, diabetes, and chronic systemic diseases. Obesity and dyslipidemia are frequently seen concomitantly. As the patient's weight problem increases, the probability of developing dyslipidemia also increases. This coexistence increases the importance of dyslipidemia screening in obese patients. The main parameters which have been used in screening are Triglyceride, LDL (low-density lipoprotein), HDL (high-density lipoprotein), and total cholesterol (3). Obesity causes cardiovascular diseases, especially heart failure, coronary artery disease, and atrial fibrillation,by causing inflammation and atherosclerosis (4).

It is important to make prospective cardiovascular risk estimations by determining the risks in terms of cardiovascular events in the population. Risk factors for cardiovascular diseases can be divided into two groups including alterable risk factors and inalterable risk factors. Inalterable risk factors include age, gender, and family history and in alterable risk factors include physical inactivity, sedentary life, obesity, smoking, diabetes mellitus, hypertension, and dyslipidemia (5). Various risk models and calculators have been developed over the years to estimate the cardiovascular risks. Cardiology societies also approve the use of models with the highest practical utility and accuracy in clinical practice. The reasons why certain risk calculators are more commonly used include ease of use, applicability to the clinician's patient population, measured outcomes, and professional community recommendations. By using current technological facilities, online calculation systems that can calculate the risk by entering the characteristics and examinations of the patients have been created. The online Cardiovascular Risk Calculation system created by the Turkish Society of Cardiology (TSC) and the online HeartScore system created by the European Society of Cardiology (ESC) for Turkey are practical evaluation systems used in the clinical practice. However, it has been stated that there are problems in terms of scoring systems and classical markers used in CVD risk assessment currently (6). The facts that these scoring systems, which are prominent in the literature, yield different risk scores for each population, the risk ratios that change with age, and they require continuous updating, suggest that new markers should be investigated to estimate cardiovascular risk (7,8).

Cardiovascular diseases have high mortality rates and also cause high cost health expenses, therefore clinicians working in primary health care institutions need tests that can signal the initial stage of the disease, enable the disease to be diagnosed earlier, and help to take measures earlier. Hemogram and biochemistry tests are the simplest and easiest to reach tests that clinicians can use in primary care. In this study, we aimed to examine whether the hematological and biochemical parameters that are available in primary health care institutions can be helpful in the earlier diagnosis of cardiovascular risk in patients who admit to the obesity outpatient clinics.

MATERIAL AND METHODS

This study is designed as a descriptive, cross-sectional, and retrospective study. The patients who admitted to the obesity outpatient clinic, between January 01st, 2017 and March 31st, 2018 and between the ages of 18 and 65 were included in the study. Demographic characteristics of the patients, existing characteristics that are thought to be associated with cardiovascular disease risk, BMI and blood test parameters were evaluated, retrospectively.

Cardiovascular Risk Calculation System: It was prepared by the Turkish Society of Cardiology, based on data from the Framingham Heart Study of the U.S. National Heart Lung and Blood Institute's to help calculate the risk of cardiovascular events within 10 years. The Cardiovascular Risk Calculation System consist of 7 questions, which includes age, LDL, HDL, systolic and diastolic blood pressures, the presence of comorbid diabetes, and whether the patient smokes or not, respectively. After determining the gender of the patient, the score and percentage of patients are determined as low, intermediate or high risk specific to the mean age range (9).

HeartScore System: The 'SCORE' system has been developed as a result of the joint decisions of the European Society of Cardiology, the European Society of Hypertension, the European Atherosclerosis Society and other societies, according to the data of 12 cohort studies conducted in Europe with different cardiovascular risk levels, since 1994. The HeartScore system we have been using is an easy-to-use, interactive form of SCORE risk charts developed and suitable for online calculation. In order to predict fatal cardiovascular events over a 10-year period, it evaluates risk factors including age, gender, systolic blood pressure, total cholesterol and HDL cholesterol values, and smoking status. According to this scoring system the risk is classified as low, intermediate, high, and very high. Regardless of other risk parameters, if the systolic blood pressure is above 180 or the total cholesterol level is above 309 the patient is accepted to be in the high risk group (10).

Statistical Analysis: Normal distribution prerequisite was examined with Kolmogorov-Smirnov and Shapiro-Wilk tests, and kurtosis and skewness coefficients were checked. Levene test was used for variance homogeneity. In the comparisons of the groups One-Way ANOVA and post hoc LSD tests were used. Pearson chi-sqaure test was used in the analysis of categorical data and multiple comparisons were examined with Bonferroni correction. Descriptive statistics are given as mean and standard deviation for numerical data, and as numbers and percentages for categorical data. Statistical analyzes were performed by using SPSS v.22 package program. A value of p> 0.05 was accepted statistically significant.

RESULTS

A total of 631 patients were included in the study; 474 (75.1%) of them were female and 157 (24.9%) were male. The mean age of the patients was 38.9±12.1 (min=21-max=65). It was found that 121 (19.2%) patients were smokers. DM was present in 29 (4.6%) and insulin resistance was present in 233 (36.9%) patients. While there was no DM in 369 (58.2%) patients. When the BMI scores of thew patients were evaluated, it was found that, 21 (3.3%) patients were underweight, 46 (7.3%) were normal weight, 142 (22.5%) were overweight, and 422 (66.9%) patients were obese (Table 1).

Table 1. Comparison of the demographic characteristics, smoking status, the presence of DM, and BMI of the participants

		Number	%
Age, Mean ±SD		38.9±12.1	
Gender	Female	474	75.1
	Male	157	24.9
Smoking status	Yes	121	19.2
	No	510	80.8
DM	No DM	369	58.5
	DM	29	4.6
	Insulin resistance	233	36.9
BMI	Underweight	21	3.3
	Normal	46	7.3
	Overweighed	142	22.5
	Obese	422	66.9

DM: Diabetes Mellitus, BMI: Body Mass Index SD: Standard Deviation

According to the risk scoring of the Turkish Society of Cardiology, 231 (51.4%) patients were at low risk, 92 (20.5%) were at intermediate risk, and 126 (28.1%) were at high risk. On the other hand, according to the risk scoring of the European Society of Cardiology, 527 (83.5%) patients were at low risk, 69 (10.9%) were at intermediate risk, and 35 (5.5%) were at high risk (Table 2).

Table 2. Distribution of cardiological risk scores of the patients

		Number	%
TSC risk score	Low	231	51.4
	Intermediate	92	20.5
	High	126	28.1
ESC risk score	Low	527	83.5
	Intermediate	69	10.9
	High	35	5.5

When the risk groups according to the TSC score were evaluated, it was found that the mean age of the patients in the intermediate risk group was the highest and the mean age of those in the low risk group was the lowest. There were significant differences between the groups in terms of age, and these differences were due to the differences between all risk groups (p<0.001). When the risk groups were compared in terms of BMI scores it was found that there were significant differences between the groups, and this differences were due to the differences between the low-risk group and the other two groups (p<0.001). It was found that the mean BMI of the patients in the low risk group was the lowest. In addition, 13.9% of the patients in the low risk group, 54.3% of those in the intermediate risk group, and 31.7% of those in the high risk group were are males. There was a significant difference between the groups in terms of gender (p<0.001). When the groups were compared in terms of the presence of DM, it was found that 0.4% of the patients in the low risk group, 4.3% of those in the intermediate risk group, and 16.7% of those in the high risk group had DM, and the presence of DM increased significantly as the risk increased (p<0.001). When the groups were compared in terms of smoking status, it was found that 13% of the patients in the low risk group, 17.4% of those in the intermediate risk group and 34.1% of those in the high risk group were smokers. There was a significant difference between the groups in terms of smoking status, and it was determined that the rate of smokers was the highest in the high risk group (p<0.001, Table 3).

Table 3. Comparison of the cardiological risk scores of the patients according to various characteristics (TSC Score)

	Low (n=231)	Intermediate (n=92)	High (n=126)	P
Age	40.36±8.92[a]	51.77±8.61[b]	46.50±9.79[c]	**<0.001**
BMI	32.85±5.97[a]	35.67±6.56[b]	36.18±5.85[b]	**<0.001**
Gender				
Male	32 (13.9)[a]	50 (54.3)[b]	40 (31.7)[c]	**<0.001**
Fermale	199 (86.1)[a]	42 (45.7)[b]	86 (68.3)[c]	
DM				
None	149 (64.5)[a]	51 (55.4)[ab]	58 (46.0)[b]	**<0.001**
Present	1 (0.4)[a]	4 (4.3)[b]	21 (16.7)[c]	
Insulin resistance	81 (35.1)[a]	37 (40.2)[a]	47 (37.3)[a]	
Smoking status				
Non smoking	201 (87.0)[a]	76 (82.6)[a]	83 (65.9)[b]	**<0.001**
smoking	30 (13.0)[a]	16 (17.4)[a]	43 (34.1)[b]	

DM: Diabetes Mellitus, BMI: Body Mass Index

When the risk groups according to the TSC score were evaluated in terms of laboratory results, it was found that there were significant differences between the risk groups in terms of platelet/lymphocyte ratios (p=0.001). The mean platelet/lymphocyte ratio of the patients in the low-risk group was higher than the other two groups. It was determined that this difference was due to the difference between the low-risk group and the other two groups. In addition, there were significant differences between the risk groups in terms of T.cholesterol/HDL ratio (p<0.001). It was determined that this difference was due to the difference between the low-risk group and the other two groups; the T. cholesterol/HDL ratio was significantly lower in the low-risk group compared to the other two groups (Table 4).

Table 4. Comparison of the laboratory result according to the cardiological risk groups (TSC Score)

	Low (n=231)	Intermediate (n=92)	High (n=126)	p
RDW	13.83±1.12	13.80±0.97	13.73±1.09	0.714
MPV	8.40±0.97	8.44±0.83	8.41±0.95	0.939
Leucocyte	7.38±1.51	7.43±1.86	7.77±1.51	0.074
NLR	1.96±1.01	1.83±0.76	1.86±0.9	0.403
PLR	124.75±55.65[a]	106.62±29.01[b]	111.21±32.99[b]	**0.001**
T.cholesterol/HDL	3.79±0.92[a]	4.75±0.93[b]	5.03±1.15[b]	**<0.001**

RDW: Red blood cell distribution width, MPV: Mean platelet volume, NLR: Neutrophile / lymphocyte ratio, PLR: Platelet/ lymphocyte ratio

When the risk groups according to the ESC score were evaluated, it was found that the mean age of the patients in the high risk group was the highest and the mean age of those in the low risk group was the lowest. The differences between the groups in terms of age were significant, and these differences were due to the differences between all risk groups (p<0.001). it was found that the mean BMI of the patients in the low risk group was the lowest, and the mean BMI of those in the high risk group was the highest. The differences between the risk groups were significant and these differences were due to the differences between all risk groups (p<0.001). In addition, the differences between the groups in terms of gender were significant (p<0.001). It was found that 20.5% of the patients in the low risk group, 44.9% of those in the intermediate risk group, and 51.4% of those in the high risk group were male. When the groups were compared in terms of the presence of DM, it was found that 3.4% of the patients in low risk group, 7.2% of those in the intermediate risk group, and 17.1% of those in the high risk group had DM, and the presence of DM increased significantly as the risk increased (p<0.001). When the groups were compared in terms of smoking status, it was found that 18.8% of the patients in the low risk group, 18.8% of those in the intermediate risk group and 25.7% of those in the high risk group were smokers. There was no significant difference between the groups in terms of smoking status (p=0.600, Table 5).

Table 5. Comparison of the demographic characteristics, smoking status, the presence of DM, and BMI of the participants (ESC score)

	Low (n=527)	Intermediate (n=69)	High (n=35)	p
Age	35.39±9.54^{a}	54.74±6.46^{b}	62.06±4.50^{c}	**<0.001**
BMI	32.23±6.95^{a}	36.20±6.53^{b}	37.11±7.08^{c}	**<0.001**
Gender				
Male	108 (20.5)^{a}	31 (44.9)^{b}	18 (51.4)^{b}	**<0.001**
Female	419 (79.5)^{a}	38 (55.1)^{b}	17 (48.6)^{b}	
DM				
None	319 (60.5)^{a}	33 (47.8)^{a}	17 (48.6)^{a}	
Present	18 (3.4)^{a}	5 (7.2)^{ab}	6 (17.1)^{b}	**0.001**
Insulin resistance	190 (36.1)^{a}	31 (44.9)^{a}	12 (34.3)^{a}	
Smoking status				
Non smoker	428 (81.2)	56 (81.2)	26 (74.3)	0.60
smoker	99 (18.8)	13 (18.8)	9 (25.7)	0

DM: Diabetes Mellitus, BMI: Body Mass Index

When the risk groups according to the TSC score were evaluated in terms of laboratory results, it was found that there were significant differences between the risk groups in terms of platelet/lymphocyte counts (p=0.004). It was determined that this difference was due to the difference between the low-risk group and the intermediate-risk group. The mean platelet/lymphocyte ratio of the patients in the low-risk group was higher than the intermediate-risk group. In addition, there were significant differences between the risk groups in terms of T.cholesterol/HDL ratio (p<0.001). It was determined that this difference was due to by the difference between the low-risk group and the other two groups; the T. cholesterol/HDL ratio was significantly lower in the low-risk group compared to the other two groups (Table 6).

Table 6. Comparison of the laboratory result according to the cardiological risk groups (ESC Score)

	Low (n=527)	Intermediate (n=69)	High (n=35)	p
RDW	13.83±1.17	13.80±0.84	13.83±0.94	0.984
MPV	8.38±0.92	8.61±1.05	8.33±0.91	0.145
Leucocyte	7.60±1.70	7.17±1.61	7.57±1.90	0.141
NLR	1.94±0.84	1.80±0.65	1.92±0.92	0.447
PLR	122.05±45.11^{a}	106.25±31.55^{b}	107.51±29.64^{ab}	**0.004**
T.cholesterol/HDL	3.99±1.11^{a}	4.86±0.97^{b}	4.88±0.99^{b}	**<0.001**

RDW: Red blood cell distribution width, MPV: Mean platelet volume, NLR: Neutrophile / lymphocyte ratio, PLR: Platelet/ lymphocyte ratio

DISCUSSION

In this study, the demographic characteristics, BMI values, smoking status, presence of DM, laboratory findings at the time of admission and cardiovascular risk scores of the patients who admitted to obesity outpatient clinic were compared. The most important finding of our study is that approximately half of the patients who admitted to the obesity outpatient clinic had intermediate and high cardiological risk. We found that, 28.1% of the patients were at high-risk according to the risk score of the Turkish Society of Cardiology, and 20.5% of them at intermediate risk. In addition, according to the risk score of the European Society of Cardiology, 5.5% were considered at high risk and 10.9% were at intermediate risk. Considering that the vast majority of our patients were overweight and obese, these high ratios of risk were expected. Such a difference in risk scoring may be related to the fact that both risk scores measure with different sensitivity for different age groups. Age is among the cardiovascular risk factors and is considered to be a non-modifiable risk factor. Advancing age has been associated with an increased risk of disability in activities of daily living and cardiovascular diseases (11). The risk of a cardiovascular disease increases with age (12). In a cohort study 3.6 million individuals aged 40 and over were screened in terms of CVD and it was reported that the prevalence of all vascular diseases increases significantly in each decade of life (13). In a large-scale cohort study conducted in Finland, by Jousilahti et al. (14), it was found that the risk of CVD increases with age. In a study conducted by Uçar (15), the CVD risk scores of patients who admitted to the Family Medicine Outpatient Clinic were examined and it was observed that the risk scores increased as the age increased. Similarly, in our study, the mean age of the patients in the high risk group was found to be higher. The increase in age is thought to be due to the increase in the formation of atherosclerotic plaque, over time.

According to the results of our study, the platelet/lymphocyte ratio was significantly lower in the high risk group compared the other two groups and T. cholesterol/HDL ratio was significantly higher in the high-risk group compared to the other two groups, when evaluated according to the TSC score. On the other hand, when the groups were evaluated according to the ESC score it was found that the platelet/lymphocyte ratio was higher in the low-risk group compared to the medium-risk group. Platelet/lymphocyte ratio (PLR) is a new prognostic marker that brings together the independent effects of these 2 parameters. It provides insight into both aggregation and inflammation pathways and may be more valuable in estimating coronary atherosclerotic burden than platelet or lymphocyte counts alone. PLR has been identified as a potential marker of the balance between thrombosis and inflammation and has been associated with increased cardiovascular morbidity and mortality.

Increased circulating platelet and decreased lymphocyte numbers have been associated with increased cardiovascular morbidity and mortality (16). It has been shown that a low number of blood lymphocyte is associated with worse cardiovascular outcomes in patients with CAD and chronic heart failure (17, 18). In addition, it has been shown that there is a relationship between circulating platelet count and major adverse cardiovascular outcomes in healthy adults as well as patients with CAD (19, 20). Our results, which are consistent with the literature, will provide help to predict the cardiovascular risks of the patients by using the hemogram tests which can be performed easily and in a short time in primary care services. The fact that our study results are also compatible with the cardiovascular risk scores used by clinicians supports the effective use of the hemogram test.

In our study, the T. Cholesterol /HDL ratio was found to be significantly higher in the high-risk group. The importance of the measurement and interpretation of LDL and HDL levels are emphasized in US National Cholesterol Education Program guidelines, since there is strong evidence that a high concentration of LDL in plasma is atherogenic and a high level of HDL is cardioprotective (21, 22).

However, measuring all these parameters individually and separately and evaluating the risk accordingly includes the bias of not being able to control the parameter that is not measured. For this reason, the ratio between these parameters has been calculated in order to evaluate various risks. Total cholesterol/HDL ratio and LDL/HDL ratio have been used for this purpose (23). Kinosian et al. (24) reported that the total cholesterol/HDL ratio was a superior tool for the evaluation of risk for CAD compared to total cholesterol or LDL cholesterol levels separately, and the authors suggested that current practice guidelines could be more efficient, if the risk stratification was based primarily on this ratio rather than LDL cholesterol level. Similarly, Onat et al. (25), in their prospective evaluation, concluded that the TC/HDL ratio is the only significant independent lipid variable in predicting future coronary death events. Söğüt et al. (26) compared the patients with angiographically detected CHD and those without CHD in terms of various variables and found that TC/HDL ratio was significantly higher in patients with angiographically detected CHD. The result of our study is compatible with the literature and the TC/HDL ratio gives very valuable information in terms of CVD risk.

Limitations: Although our study included a relatively high number of patients, it reflects only a local area results. In this context, it should be noted that we cannot generalize our results. Prospective studies with larger samples are needed to clearly define the relationship between PLR and CVD risk.

CONCLUSION

Our study results show that hemogram and biochemical tests, which can be performed easily and provide short-term results in primary care, can be used to predict cardiovascular risk. Studies generally make a limited examination of the disease when assessing CVD risk. However, studies in which all CVD risks are evaluated together will provide insight for the determination of the dimensions of the relationship.

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