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Monocyte to High-Density Lipoprotein Cholesterol Ratio in Patients with Retinal Artery Occlusion

Retinal Arter Oklüzyonu Olan Hastalarda Monosit/Yüksek Dansiteli Lipoprotein Kolesterol Oranı

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ÖZET

Amaç: Retinal arter oklüzyonu (RAO), oftalmolojik hastalıkların en önemli acil durumlarından biridir. Tromboembolizm RAO'nun ana etiyolojik faktörüdür. Monosit/yüksek dansiteli lipoprotein kolesterol (HDL) oranını (MHO), çeşitli inflamatuar bozukluklarda, kardiyovasküler ve serebrovasküler hastalıklarda yeni bir prognostik biyobelirteçtir. Bu çalışmanın amacı RAO geçirmiş hastalarda MHO incelemektir.

Gereç ve Yöntemler: Retrospektif olarak yapılan bu çalışmada, Ocak 2015 ile Mayıs 2019 tarihleri arasında muayene olan hastaların dosya kayıtları değerlendirildi. Çalışmaya toplam 76 hasta dahil edildi. Hastalar iki gruba ayrıldı. RAO tanısı alan 38 hasta grup 1, 38 katılımcı ise grup 2 (kontrol grubu) olarak kabul edildi. Grup 1'de 23 hasta santral retinal arter oklüzyonu (SRAO), 15 hasta ise retinal arter dal oklüzyonu (RADO) olarak sınıflandırıldı.

Bulgular: Gruplar arasında cinsiyet ve yaş açısından fark yoktu (p=0,231 ve p=0,685). Gruplar kardiyovasküler hastalıklar, sistemik hipertansiyon ve diyabet açısından benzerdi (p=0,341, p=0,427, p=0,554, sırasıyla). Ortalama MHO, RAO grubunda kontrol grubuna göre anlamlı olarak daha yüksekti (14.9±5.5'e karşı 7.9±1.9, p <0.001). Alıcı çalışma karakteristikleri analizinde, MHO için eğri altındaki alan 0.908 olup MHO > 9.95 değeri % 89.5 duyarlılık ve % 84.2 özgüllük ile RAO' yu öngörmüştür. Tek değişkenli lojistik regresyonda, MHO'nın, RAO' nun bağımsız bir prediktörü olduğu görülmüştür (OR = 1.892; % 95 CI = 1.398-2.561; p <0.001).

Sonuç: MHO'nın sistemik inflamasyon ve vasküler-tıkayıcı hastalıklar için basit, kullanışlı ve ucuz bir öngörücü biyobelirteç olduğu gösterilmiştir. Çalışmamız, artmış MHO'nın RAO ile önemli ölçüde ilişkili olduğunu göstermiştir. Ayrıca, MHO'nın hem SRAO hem de RADO'da daha yüksek olduğunu ortaya koymuştur. Bu nedenle MHO, riskli hastalarda RAO' nun gelişmesi açısından öngörücü bir biyobelirteç olabilir.

Anahtar Kelimeler: Monosit/yüksek yoğunluklu lipoprotein kolesterol oranı, santral retinal arter oklüzyonu, retinal arter dal oklüzyonu, ateroskleroz, inflamasyon

ABSTRACT

Aim: Retinal artery occlusion (RAO) is one of the most important emergencies of ophthalmologic diseases. Thromboembolism is the main etiological factor in RAO. Monocyte to HDL cholesterol ratio (MHR) is a novel prognostic biomarker in several inflammatory disorders, various cardiovascular and cerebrovascular diseases. In this study, it was aimed to investigate MHR in RAO patients.

Materials and Methods: In this retrospective study, the record files of subjects who were examined between January 2015 and May 2019 were reviewed. Seventy-six subjects were enrolled in the groups. Thirty-eight patients with RAO were considered as group 1, 38 participants were considered as group 2 (control group). In group 1, 23 patients were classified as central retinal artery occlusion (CRAO), and 15 patients were classified as branch retinal artery occlusion (BRAO).

Results: There was no difference in terms of gender and age among the groups (p=0.231 and p=0.685). As well, the groups were similar in terms of cardiovascular diseases, systemic hypertension, and diabetes mellitus (p=0.341, p=0.427, p=0.554, respectively). The mean MHR was higher in group 1 compared to the group 2, significantly (14.9±5.5 vs 7.9±1.9, p<0.001). The area under the curve for MHR was 0.908 in receiver operating characteristics analysis and an MHR of > 9.95 predicted RAO with a specificity of 84.2% and sensitivity of 89.5%. In univariate logistic regression, MHR was found to be an independent predictor of RAO (OR=1,892; 95% CI=1,398-2,561; p<0,001).

Conclusions: MHR has been shown to be a simple, useful and inexpensive predictive biomarker for systemic inflammation and vascular-occlusive diseases. Our study showed that increased MHR was significantly associated with RAO. Also, we have researched the level of MHR in patients with RAO and presented that MHR is higher in both CRAO and BRAO. Therefore, MHR may be a predictive biomarker for the emergence of RAO in risky patients.

Keywords: Monocyte to high-density lipoprotein cholesterol ratio, central retinal artery occlusion, branch retinal artery occlusion, atherosclerosis, inflammation

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INTRODUCTION

Retinal artery occlusion (RAO) is one of the most important emergencies of ophthalmologic diseases (1). Painless, sudden unilateral partial/total loss of vision that develops within minutes or hours is the symptoms of RAO. The incidence of RAO varies between 1 and 3 in 100 000 (2,3). Although this disease can be seen in the first and ninth decades, it occurs most often in the sixth decade and bilateral involvement was observed in 1-2% of the cases (2). In general, RAO is categorized as branch retinal artery occlusion (BRAO) and central retinal artery occlusion (CRAO) due to the placement of the occluded artery. CRAO is more common than BRAO but BRAO is more than CRAO when only young patients are considered (4).

Thromboembolism is the main etiological factor both in BRAO and CRAO (5). Major risk factors in elderly patients are systemic hypertension, diabetes mellitus, atherosclerosis, cardiovascular and cerebrovascular diseases (5). Embolic events due to vasculitis, congenital vascular or cardiac anomalies, hyperhomocysteinemia, antiphospholipid antibody syndrome, and hypercoagulability are more prominent in young patients (6,7). Particularly, atherosclerosis is the major risk factor of many vascular-occlusive disorders such as atrial fibrillation, acute myocardial infarction (AMI), stroke, and retinal vein occlusion (8,9). In addition, increased inflammation and accumulation of lipids are the main features of atherosclerosis (10,11).

It is known that monocytes have a major mission in the pro-inflammatory cascades, pro-oxidant reactions, and development of atherosclerosis. Besides, high-density lipoprotein cholesterol (HDL-c) has reverse effects against monocytes (12,13). Recently, it has been shown that monocyte to HDL cholesterol ratio (MHR) is a novel prognostic biomarker in several inflammatory disorders, various cardiovascular and cerebrovascular diseases (14-17). From this point of view, it was aimed in this study to analyze the MHR level in RAO patients.

MATERIALS AND METHODS

This retrospective study adhered to the principles of the Declaration of Helsinki and was conducted in the Department of Ophthalmology at Necmettin Erbakan University, Faculty of Medicine with approval from the local ethics committee. The record files of subjects who were examined between January 2015 and May 2019 were reviewed and 38 patients (CRAO=23 patients, BRAO=15 patients) who were diagnosed with signs of an acute RAO were participated in this study.

Basically, subjects who had an anamnesis of sudden vision loss in one eye were diagnosed with CRAO in case of albescent retina with cherry red spot due to the retinal ischemia by dilated fundus examination. In addition, BRAO diagnosis was based on due to visualization of retinal opacity in the region of occluded branch retinal artery or visualization of emboli located at occluded branch retinal artery in patients with an anamnesis of sudden visual deterioration in one eye. Also, spectral-domain optical coherence tomography (SD-OCT) was done at first visit to all patients to detect acute retinal edema.

After the subjects had fasted for at least 12 hours, venous blood was drawn into K2-EDTA tubes. An automated hematology analyzer (XN-1000, Sysmex America, Inc.) was used to count the monocytes in each subject, and a chemistry analyzer (ARCHITECT c16000, Abbott, Illinois, USA) was used to measure the HDL levels. By dividing each subject's monocyte count by their HDL level, the MHR was determined.

All subjects with inadequate information or doubtful diagnosis and RAO patients presenting later than 5 days of symptom onset were excluded. Also, the patients who have anamnesis of any ocular diseases, of vasculitis, of blood dyscrasias, of hepatic disorders, of renal failure, of autoimmune diseases, of acute systemic infections; and the patients with a history of surgery recently, with a history of any systemic/topical medication usage such as non-steroid/steroid drugs, anti-hyperlipidemic medications, anticoagulant medications, and alcohol consumption were not included in the groups. In addition, the control group was created from subjects with senile cataracts.

The statistical analyses were done by SPSS 20.0 software (SPSS Inc., Chicago, IL). Number and percentage values were used to express the categorical variables. Numerical variables with a normal distribution were displayed as mean±standard deviation (SD). To analyze categorical data, the Pearson chi-square test was employed. For non-parametric values between groups, the Kruskal-Wallis test was employed, and for parametric values between groups, the one-way ANOVA test was utilized. In order to predict the sensitivity and specificity for RAO, the best cut-off value for MHR was determined using receiver-operating-characteristic (ROC) curves. A measure of

Table 1. Demographic characteristics and hematologic parameters of the groups.

	Mean ± SD		p
	RAO Group	Control Group	
Gender (Female/Male)	11/27	16/22	0.231
Age (years)	60.7±16.1	61.2±6.1	0.685
Monocyte (×109/L)	634.4±165.1	397.5±107.6	<0.001
HDL (mg/dL)	44.5±8.4	51.21±10.1	0.002
MHR	14.9±5.5	7.9±1.9	<0.001
Cardiovascular disease (n)	10	6	0.341
Hypertension (n)	11	8	0.427
Diabetes mellitus (n)	8	6	0.554

HDL: High-density lipoprotein MHR: Monocyte/HDL ratio

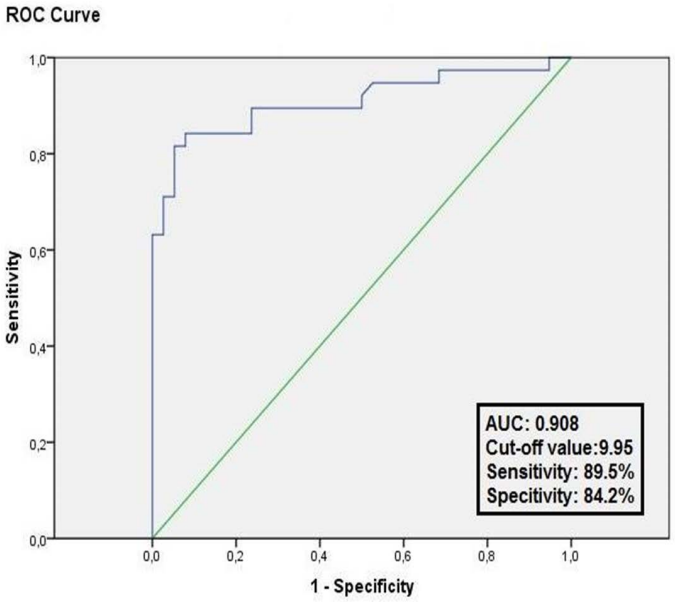

Figure 1. The receiver-operating characteristic curve analysis for MHR in RAO.

the test's accuracy called the area under the curve (AUC) was computed. A univariate logistic regression model was used to calculate the adjusted odds ratio (OR) and 95% confidence interval (CI) for the independent association between MHR and RAO. At $P < 0.05$, statistical significance was established.

RESULTS

The demographic characteristics and laboratory parameters were shown in Table 1. The groups did not differ in terms of gender or age (p=0.231 and p=0.685). As well, the groups' rates of diabetes mellitus, systemic hypertension, and cardiovascular diseases were comparable (p=0.341, p=0.427, p=0.554, respectively).

When laboratory parameters were compared between the two groups, it was found that the RAO patients had a considerably higher mean MHR (p <0.001). Also, the optimal cut-off value of MHR for RAO was calculated as 9.95 with 84.2% specificity and 89.5% sensitivity and AUC was 0.908 (Figure 1). Furthermore, an investigation of univariate logistic regression revealed that MHR was a separate predictor of RAO (OR=1,892; 95% CI=1,398 -2,561; p<0,001).

Moreover, there were no differences in gender, age, the mean monocyte count, HDL, and MHR values between the patients with BRAO and CRAO (p=0.791, p=0.695, p=0.767, p=0.156, p=0.083).

DISCUSSION

Actually, inflammation is a defense mechanism which is a body response in case of acute stress but in many systemic disorders such as cardiovascular diseases, cancer, and atherosclerosis there is a subclinical inflammation due to the persistent elevation of inflammatory biomarkers (18-22). Basically, monocytes, smooth muscle cells, lymphocytes infiltration and lipid accumulation into the arterial wall which starts a continuous inflammatory reaction is the hallmarks of atherosclerosis (23). In this inflammatory cascade, monocytes and macrophages have a pivotal role (24). They are the main source of certain proinflammatory cytokines and reactive oxygen species (24). As a result, the accumulation of these substances develops atherosclerotic plaque. When vulnerable plaques rupture, thromboembolic events arise and acute ischemia occurs due to the complete occlusion of the blood vessel in the affected tissue (25,26). Indeed, the eye is one of the target organs in thromboembolic events.

As far as is known, the etiology of RAO is multifactorial. Many disorders may be the reason for this ophthalmic emergency. Carotid artery dissection, cardiogenic embolism, giant cell arteritis, Susac syndrome, Fabry disease, sickle cell disease are the possible causes of RAO but it is known that 70% cause of BRAO or CRAO is ipsilateral internal carotid artery (ICA) atherosclerosis (27-30). The first branch of the ICA is ophthalmic artery and because of this reason it is an easy path for thromboembolic plaque to cause occlusions in the eye, primarily. The source of thromboembolism is usually fibrin or cholesterol plaque from the atherosclerotic background and particularly, thromboembolic plaque can cause blockages at the distal side to the bifurcation of retinal arteries (29). These thromboembolic plaques may be visible at admission in approximately 40% of patients (31). Thus, the absence of a thromboembolic plaque does not exclude the possibility of embolic occlusion. The possible causes of and risk fac¬tors for RAO are similar to those of cerebrovascular ischemic events, coronary artery disease (CAD), ischemic heart disease and it is known that RAO is associated with systemic hypertension, diabetes mellitus, cardiovascular diseases (32). Moreover, many studies have revealed that there is a co-occurrence of ischemic stroke (IS), transient ischemic attack or AMI with RAO (30,33,34). Avery and colleagues have reported that ocular ischemic syndrome, BRAO, and CRAO are significantly associated with stroke and Park et al. showed that AMI and IS significantly increased in the first month after CRAO occurrence especially in the first 7 days (35,36).

Monocytes are the responsible cells in the first steps of prooxidant and proinflammatory and reactions in atherosclerosis (12). Besides; HDL-c protects cells from inflammatory reactions by inhibiting the oxidation of low-density lipoprotein cholesterol, reducing macrophage migration, and monocyte activation (13). More recently, MHR was proposed as a novel marker in many inflammatory disorders, cardiovascular and cerebrovascular diseases (14-17). This is because MHR shows the equalization of pro- and anti-inflammatory reactions. Bolayir et al. published that MHR level is a predictor of 30-day mortality in patients with acute IS (17). As well, Korkmaz et al. reported that increased MHR values were independently associated with functionally

significant coronary artery lesions (37). Cetin and colleagues have demonstrated that MHR is an independent predictor of severity of CAD (38).

In this article, we have researched the level of MHR in patients with RAO and presented that MHR is higher in both CRAO and BRAO. It is important to state that MHR, particularly in subjects with thromboembolic events, may be a useful marker for predicting the risk of RAO. The limitations of this study are evidently a small sample size, retrospective design, and single-center study methodology.

CONCLUSIONS

As discussed above, it has been shown that MHR is a simple, useful, and inexpensive predictive biomarker of systemic inflammation and vascular-occlusive diseases. In addition, patients with thromboembolic events have a higher risk of RAO due to possible similar etiology. In this regard, MHR value may be a practical biomarker for evaluation of RAO development in risky subjects.

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