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Assessment of the white blood cell subtypes ratio in patients with supraventricular tachycardia: Retrospective cohort study

Beyaz küre alt tipleri oranının supraventriküler taşikardili hastalarda değerlendirilmesi: Retrospektif kohort çalışma

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Abstract

Aim: Neutrophil/lymphocyte ratio (NLR), monocyte/lymphocyte ratio (MLR) and lymphocyte/monocyte ratio (LMR) have been considered to be the new cardiovascular risk predictors. Inflammation has been shown to be associated with various types of arrhythmia. This study aimed to investigate the relationship between NLR, LMR and MLR in patients with supraventricular tachycardia (SVT).

Methods: Our study included 59 patients aged 18 years or older who visited our clinic between December 2017 and December 2018. Thirty-three patients were diagnosed with definitive diagnosis of tachycardia using electrocardiographic (ECG) method, and hospitalized for ablation. The other 26 patients were the ones who underwent electrophysiological study (EPS) as it was not possible to make a diagnosis of arrhythmia using non-invasive methods despite ongoing complaints of palpitation. Blood samples were taken from all patients for pre-operative complete blood count analysis. NLR was calculated as the ratio of neutrophil count to lymphocyte count. MLR was calculated as the ratio of monocyte count to lymphocyte count. LMR was calculated as the ratio of lymphocyte count to monocyte count. In addition, electrophysiological study (EPS) was performed for treatment purposes in patients diagnosed with SVT; and for diagnosis and treatment purposes in patients who have the complaint of palpitation, however, could not be diagnosed using non-invasive methods.

Results: This study included 33 patients with SVT and 26 healthy controls who underwent EPS. When hematological parameters were compared, there was no statistically significant difference in NLR values (1.96 (0.69) 103/μL vs. 2.17 (1.29) 103/μL, *P*=0.42). Moreover, both MLR (0.25 (0.09) 103/μL vs. 0.22 (0.08)) 103/μL, *P*=0.19) and LMR (4.64 (1.37) 103/μL vs. 4.64 (1.45)) 103/μL, *P*=0.49) were not statistically significant between the two groups.

Conclusion: This study showed that NLR, LMR and MLR values cannot be used as predictors for the presence of SVT.

Keywords: White blood cell subtypes, Supraventricular tachycardia, Inflammation

Öz

Amaç: Nötrofil/lenfosit oranı (NLO), monosit/lenfosit oranı (MLO) ve lenfosif/monosit oranı (LMO) yeni kardiyovasküler risk belirleyicileri olarak değerlendirilmiştir. Inflammation has been demonstrated to be associated with various types of arrhythmia. Bu çalışmadaki amacımız geriye dönük olarak supraventriküler taşikardi (SVT) tanılı hastalarda NLO, LMO ve MLO ile ilişkisini araştırmayı amaçladık.

Yöntemler: Çalışmamız 18 yaş ve üzerinde, Aralık 2017- Aralık 2018 tarihleri arasında kliniğimizde takip edilen 59 hastayı içermektedir. Hastaların 33 tanesi çarpıntı tanısı konmuş ablasyon için yatış verdiğimiz hastalar olup, diğer 26 tanesi noninvaziv yöntemlerle ritm bozukluğu tanısı konulamayan fakat çarpıntı şikayetleri devam eden kesin tanısını koyabilmek için elektrofizyolojik çalışma (EPS) yaptığımız hastalardan oluşmaktadır. Tüm hastalardan işlem öncesi hemogram ölçümü için kan örneği alındı. NLO değeri nötrofil sayısının lenfosit sayısına oranı, MLO değeri monosit sayısının lenfosit sayısına oranı ve LMO değeri lenfosit sayısının monosit sayısına oranı olarak hesaplandı. Ayrıca SVT tanısı mevcut hastalarımıza tedavi amaçlı; hem de noninvaziv yöntemlerle tanısı konulamayan çarpıntı hastalarına tanı ve tedavi amaçlı EPS yapıldı.

Bulgular: Çalışmaya SVT'li 33 hasta ve EPS sonucu normal olan 26 tane sağlıklı kontrol grubu dahil edildi. Hematolojik parametreler karşılaştırıldığında NLO (1,96 (0,69) 103/μL karşı 2,17 (1,28) 103/μL, *P*=0,42) istatiksel olarak anlamlı değildi. Bir diğer parametrelerde hem MLO iki grup arasında (0,25 (0,09) 103/μL karşı 0,22 (0,08) 103/μL, *P*=0,19) hem de LMO iki grup arasında istatiksel olarak anlamlı değildi. (4,38 (1,37) 103/μL karşı 4,64 (1,45) 103/μL, *P*=0,49).

Sonuç: Yaptığımız çalışmada NLO, LMO ve MLO değerlerinin SVT'nin varlığı için kullanılabilir gösterge olmadıklarını göstermiş olduk.

Anahtar kelimeler: Beyaz kan hücresi alt tipleri, Supraventriküler taşikardi, İnflamasyon

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Introduction

Supraventricular tachycardia (SVT), also called paroxysmal supraventricular tachycardia, is defined as an abnormally rapid heartbeat. It is a broad term that includes many heart rhythm disorders that originates from the region above the atrium or AV node. The normal heart rate is 60 to 100 beats per minute. Having a heart rate above 100 beats per minute is called tachycardia. There are three main types of SVT; AV nodal re-entrant tachycardia (AVNRT), atrioventricular re-entrant tachycardia (AVRT) and atrial Tachycardia (AT). Recently, neutrophil / lymphocyte ratio (NLR), monocyte/lymphocyte ratio (MLR) and lymphocyte/monocyte ratio (LMR) values which can be calculated rapidly were considered as new predictors for cardiovascular diseases [1-3].

Previous studies in the field of arrhythmia have shown that inflammation plays a predisposing role for SVT [4,5]. However, data about the relationship between SVT, and NLR, LMR and MLR is not sufficient. Therefore, we aimed to investigate the relationship between NLR, LMR and MLR levels in patients with definite diagnosis of SVT.

Materials and methods

This retrospective study consisted of 59 patients who were followed-up at our clinic between December 2017 and December 2018. Electrophysiological study (EPS) was performed in all patients. Ethics committee approval was not received as the study design was retrospective and written informed consent was obtained from all patients before the procedure. All participants underwent diagnostic EPS procedure. Successful RF catheter ablation procedure was performed in patients with diagnosed SVT. EP Tracer electrophysiology system, Medtronic stimulator and Atakr RF generator were used in the study. Patients with a history of past ablation, renal dysfunction (serum creatinine level being >1.5 mg/dL), cancer, cerebral vascular disease, hematological disorders, patients with a history of infection in the past two weeks, acute or chronic infection, hepatic dysfunction, immunosuppressant, anti-inflammatory or patients receiving steroids were excluded from the study.

Sampling and laboratory analysis

The blood samples were taken through antecubital vein into dry tubes and into tubes containing ethylenediaminetetraacetic acid (EDTA). Dry tubes were used for the biochemical analysis and EDTA tubes were used for the hematological analysis. MLR was calculated as the ratio of monocyte count to lymphocyte count. NLR was calculated as the ratio of neutrophil count to lymphocyte count. LMR was calculated as the ratio of lymphocyte count to monocyte count.

Statistical analysis

Statistical analysis was performed using SPSS 21.0 (IBM 1989, 2012) package software. Continuous data were expressed as mean (standard deviation), and categorical data were expressed as number and percentage. Categorical data were compared by chi-square test; continuous data were analyzed by Student's t-test after testing for normal distribution. A *P* value of <0.05 was considered to be statistically significant.

Results

Table 1 summarizes the baseline demographic and clinical characteristics, and laboratory findings of the patients included in this study. The study population consisted of 59 patients.

The mean age was 44.85 years, and 47 patients (79%) were female. There were no statistically significant differences between the groups in terms of age, sex, smoking status, and hemoglobin, monocyte and lymphocyte levels. RF ablation treatment was performed in 33 patients. In EPS, the neutrophil count was 4.77 (1.76) x 10^3/μL. In SVT, the neutrophil count was 4.32 (1.40) x 10^3/μL. In the control group the monocyte count was 0.54 (0.25) x 10^3/μL. In the study group the monocyte count was 0.55 (0.18) x 10^3/μL.

Consequently, NLR, LMR and MLR values were analyzed in the control and the study groups, and there was no significant difference found between the groups (figure 1-3).

Table 1: Baseline demographic, biochemical and hematological characteristics of the study population (n=59)

	Study group mean (SD)	Control group mean (SD)	*P*-value
Age	45.94 (14.96)	43.77 (8.97)	0.49
*Female, n(%)	24 (72.7)	23 (88.5)	0.14
*Tobacco use, n(%)	9 (27.3)	6 (23.1)	0.71
Glucose (mg/dL)	102.09 (23.15)	122.82 (61.04)	0.11
Creatinine, mg/dL,	0.78 (0.16)	0.74 (0.13)	0.31
Hemoglobin, g/L	13.87 (1.93)	13.40 (1.67)	0.33
Neutrophil count, x10^3/μL	4.32 (1.40)	4.77 (1.76)	0.28
Lymphocyte count, x10^3/μL	2.32 (0.68)	2.48 (1.04)	0.48
Monocyte count, x10^3/μL	0.55 (0.18)	0.54 (0.25)	0.82
Neutrophil/lymphocyte ratio	1.96 (0.69)	2.17 (1.28)	0.42
Monocyte/lymphocyte ratio	0.25 (0.09)	0.22 (0.08)	0.19
Lymphocyte/monocyte ratio	4.38 (1.37)	4.64 (1.45)	0.49

SD: Standard deviation, SVT: supraventricular tachycardia, EPS: Electrophysiological study, * Chi-square test was performed for these parameters, and Student's t-test for other parameters

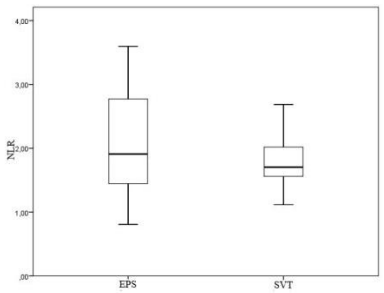

Figure 1: Comparison of the neutrophil/lymphocyte ratio between the patients with supraventricular tachycardia and the control subjects

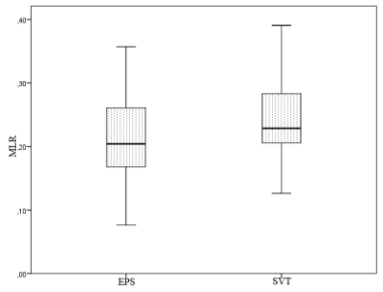

Figure 2: Comparison of the monocyte/lymphocyte ratio between the patients with supraventricular tachycardia and the control subjects

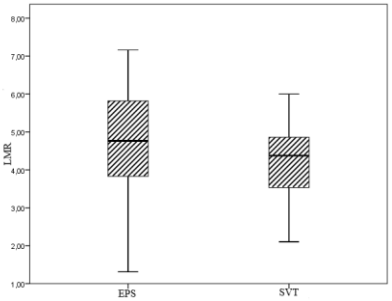

Figure 3: Comparison of the lymphocyte/monocyte ratio between the patients with supraventricular tachycardia and the control subjects

Discussion

The pathogenesis of cardiac arrhythmias is complex. In their study, Klein et al. have previously shown that inflammation plays an active role in the pathogenesis cardiac arrhythmias. As the mechanism, they have shown that inflammation markers which increase in infectious states lead to myocardial fibrosis, increased wall tension, and eventually, increases myocardial oxygen consumption. In the end, reduced coronary reserve flow and impaired intercellular action potential in myocardial cells trigger arrhythmia [6].

The three main causes of a narrow QRS tachycardia are atrial tachycardia, orthodromic AV re-entrant tachycardia, and AV nodal re-entrant tachycardia.

Antiarrhythmic drugs help control arrhythmias, but they may also cause arrhythmias, and thereby, the symptoms would also continue. Many studies recommended use of catheter ablation [7].

NLR may be associated with the onset of arrhythmias in adults, thus, this may indicate a possible inflammatory etiology. Some studies have demonstrated inflammation has important implications for risk assessment for cardiovascular diseases [8].

Elevated levels of systemic inflammation markers are associated with cardiovascular disease [9].

NLR and MLR were considered as new cardiovascular risk factors. This study aimed to show whether there was a difference between NLR and MLR values in the control and the study groups. The results of our study showed that there was no significant difference between the groups. Recent studies have demonstrated the significance of NLR in cardiovascular diseases and SVTs. There is a positive correlation between the NLR and inflammation markers [10]. Some studies have suggested that inflammatory processes contribute to atrial arrhythmias [11-12]. For example, Osmancık et al. [13] reported that atrial fibrillation is associated with the activation of inflammatory processes [e.g. higher concentrations of pro-inflammatory cytokines, interleukin-6 (IL-6), C-reactive protein (CRP)]. According to their study, successful ablation of AF together with sinus rhythm restoration and maintenance is associated with reduced serum levels of inflammation markers. In another study, Ocak et al. [14] found lymphocyte counts were similar in supraventricular tachyarrhythmia in patients with documented atrial tachyarrhythmia and healthy adults in the emergency department (ED). Aydın et al. [15] found SVT inducibility during EPS was associated with higher NLR levels.

Our results differ from those of other studies, and we believe there are two reasons for this. Firstly, the study population consisted of patients who are mainly of female gender in both the EPS and the ablation arms. Secondly, we selected the control group participants from patients who were found normal after EPS.

In the present study, there was no statistically significant difference between the groups in terms of age. Several studies have showed that hematopoiesis changes occur at different estrogen levels during menopause. Different cut-off values should be set by race and age. Despite being inexpensive and easy, the application of hematologic markers in clinical practice can be challenging due to lack of standardization and evidence [16,17].

Study limitations

The majority of our study participants were of female gender. This is a single-center, retrospective study, the number of patients is relatively small, and other inflammation markers such as TNF- α, IL- 1, and IL-6 were not measured.

Conclusion

In conclusion, there was no significant difference found NLR, LMR and MLR values in patients with study groups compared with control groups. In addition, we detected higher MLR values in patients in study group. Further large-scale, prospective, and multicenter studies are needed to confirm the association between NLR, LMR and MLR and SVT.

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