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Original Article

The value of hematological inflammatory parameters in the differential diagnosis of testicular torsion and epididymorchitis

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Abstract: Objective: Aim of this study is to investigate the effectiveness of mean platelet volume (MPV), neutrophil to lymphocyte ratio (NLR) and platelet to lymphocyte ratio (PLR) values, that can easily be obtained with complete blood count (CBC), in the diagnostic differentiation of testicular torsion and epididymorchitis. Method: Data of patients, who admitted to the urology or emergency departments, diagnosed with acute scrotum, between 2008-2017, were reviewed and retrospectively extracted. Basic characteristics (age,etc.) of patients and blood test results were retrieved. Inflammatory markers such as MPV, NLR and PLR were compared between groups. Result: After determining inclusion/exclusion criteria, a total of 111 patients were divided as testicular torsion, epididymorchitis and control group, including 37 patients each. Mean age of groups were 19.27±6.93, 26.27±6.23 and 23.24±8.49 years, respectively. Statistical significance was found in epididymorchitis and testicular torsion groups compared to the control group according to NLR ($P<0.01$). PLR showed a statistically significant relationship only with the epididymorchitis group and control group ($P=0.46$). However, according to MPV values, no statistically significance was found between the groups. Additionally, ROC analyse was performed to evaluate predictive cut-off values of NLR and PLR for the diagnostic differentiation of both groups. Conclusion: Inflammatory markers, obtained from routinely performed low-cost CBC, might be used as adjuvant parameters to differentiate acute scrotal pathologies like testicular torsion and epididymorchitis.

Keywords: Epididymorchitis, lymphocyte, neutrophil, platelet, testicular torsion

Introduction

Testicular torsion, which is an acute scrotal pathology like epididymorchitis, requires urgent surgical intervention. Thus, in urological practice, it is crucial to differentiate both diagnoses, as soon as possible. Clinical management is based on medical history, physical examination, laboratory tests and imaging [1, 2]. However, physical examination is often deceptive, and scrotal doppler ultrasonography (USG), can lead to false negative results [3].

Values such as neutrophil lymphocyte ratio (NLR), platelet lymphocyte ratio (PLR) and mean platelet volume (MPV), which are easy to access, have been shown to be useful in the diagnosis and follow-up of various pathologies like malignancy, infections and inflammatory incidents [4-6]. Many studies have reported the increase of inflammatory markers in epididymorchitis [2, 7]. However, it has also been shown that these inflammatory markers may increase in testicular torsion, due to hypoxic tissue damage, as well [2, 8]. Hypoxia and inflammation caused by decreased blood supply in testicular torsion, can be associated with the hypoxic myocardium in acute coronary syndrome. It has been reported that high NLR values can be predictive for acute coronary syndrome and a guide in progression [9].

Furthermore, evaluating testes as endocrine organs, NLR and PLR has also been shown for being effective in diagnosing inflammatory and non-inflammatory diseases of the pancreas

Table 1. Variable comparisons between groups with Kruskal-Wallis Test results

	Testicular Torsion (n=37)	*Epididymorchitis (n=37)*	*Control (n=37)*	*p value*
Age	19.27 ± 6.93*	26.27 ± 6.23*	23.24 ± 8.49*	<0.01
PLR	120.89 (85.5-183.32)**	134.5 (99.6-163.17)**	106.1 (88.9-129.9)**	<0.05
NLR	3.32 (1.92-5.58)**	2.54 (1.68-9.70)**	1.56 (1.23-2.49)**	<0.01
MPV	8.66 ± 1.07*	8.8 (8.10-9.70)**	9.23 ± 1.47*	=0.189

*The values were given as mean ± standard deviation for normally distributed parameters. **The values were given as median (25^{th}-75^{th} percentiles) for non-normally distributed parameters. PLR: Platelet/lymphocyte ratio, NLR: Neutrophil/lymphocyte ratio, MPV: Mean platelet volume.

and thyroid [10, 11]. Studies, investigating efficiencies of hematological parameters for the differential diagnosis of testicular torsion and epididymorchitis are, limited and have recently gained importance [12-14].

Therefore, our aim is to compare NLR, PLR and MPV values, that can be obtained from routinely performed and low-cost complete blood count (CBC) tests, for the differentiation of both acute scrotal pathologies.

Material and methods

Data extraction

Data of patients, who admitted to the urology or emergency departments of two University Hospitals, diagnosed with acute scrotum, between 2008-2017, were reviewed and retrospectively extracted. Basic demographic characteristics (age, etc.) and blood test results including CBC and routine biochemical parameters, of all patients, were retrieved based on both hospitals electronic database. Informed consents were taken and institutional review board was approved by the university scientific research ethics committee.

Patient selection and definition of compared parameters

Patients, who were examined by a urologist and diagnosed with epididymorchitis and/or testicular torsion, according to scrotal doppler USG imaging, were included to the study. In addition, unoperated healthy individuals with grade1 varicocele, who admitted to the outpatient clinic, were included to the study as a control group.

Exclusion criteria were as follows: i) patients with any malignancy; ii) presence of another active infection; iii) disease causing increased inflammatory response (e.g. familial mediterranean fever); iv) hematologic diseases affecting blood count; and/or v) receiving chemotherapy, meanwhile.

Complete blood count based systemic inflammatory markers such as mean platelet volume (MPV), neutrophil to lymphocyte ratio (NLR) and platelet to lymphocyte ratio (PLR) were evaluated, to compare between the groups.

Statistical analysis

Data was analyzed by using SPSS version 23.0.0.0. Shapiro-Wilk test was used to check for normality of independent variables. Kruskal-Wallis test was performed to compare the groups. In order to identify statistically significant differences between groups, Mann-Whitney-U test and Student-T test was compared. Receiver operating characteristics (ROC) curve analyses to assess the discriminative of biomarkers was performed.

Results

After determining inclusion/exclusion criteria, a total of 111 patients were divided as testicular torsion, epididymorchitis and control group including 37 patients each. Patients' age, PLR, NLR and MPV values were compared.

Basic patient and descriptive characteristics

Descriptive properties and their distribution with respect to groups are summarized in **Table 1**. Mean age of groups were 19.27 ± 6.93, 26.27 ± 6.23 and 23.24 ± 8.49 years, respectively. Differences according to NLR and PLR values were statistically significant between all groups (P<0.01). Post hoc tests performed, to further determine differences between the groups, showed that NLR values was statistically higher in the epididymorchitis and testicu-

Table 2. Receiver operating curve analysis results for testicular torsion-control groups

	Cut-off value	*Sensitivity*	*Specificity*	*PPV*	*NPV*	*AUC (95% Confidence Interval)*
PLR	>137	0.44	0.86	0.76	0.61	0.61 (0.65-0.85
NLR	>2.88	0.57	0.87	0.81	0.67	0.73 (0.62-0.83)

PLR: Platelet/lymphocyte ratio, NLR: Neutrophil/lymphocyte ratio, PPV: Positive predictive value, NPV: Negative predictive value, AUC: Area under the curve.

Table 3. Receiver operating curve analysis results for epididymorchitis -control groups

	Cut-off value	*Sensitivity*	*Specificity*	*PPV*	*NPV*	*AUC (95% Confidence Interval)*
PLR	>137	0.48	0.86	0.78	0.62	0.67 (0.60-0.82)
NLR	>1.62	0.76	0.57	0.64	0.70	0.68 (0.56-0.78)

PLR: Platelet/lymphocyte ratio, NLR: Neutrophil/lymphocyte ratio, PPV: Positive predictive value, NPV: Negative predictive value, AUC: Area under the curve.

lar torsion group compared to the control group (P<0.01). Whereas, PLR values showed only a statistically significant relationship between the epididymorchitis and control group (P= 0.46). No statistically significance between the groups was found according to MPV values (P=0.189) (**Table 1**).

Acquired variables according to groups

To evaluate predictive cut-off values for NLR and PLR, in the diagnosis of testicular torsion, ROC curve analyze was used. The cut off values for NLR and PLR, shown in **Table 2**, were found as 2.88 (Area under the curve (AUC): 0.73, sensitivity 57%, specificity 87%) and 137 (AUC: 0.61, sensitivity 44%, specificity 86%), respectively. Whereas, in the diagnosis of epididymorchitis, predictive cut off values for NLR and PLR, shown in **Table 3**, were found as 1.62 (Area under the curve (AUC): 0.68, sensitivity 76%, specificity 57%) and 137 (AUC: 0.67, sensitivity 48%, specificity 86%), respectively.

Discussion

Our study demonstrated that, CBC-based inflammatory markers like NLR and PLR values are significantly higher in acute scrotal pathologies, including inflammatory or non-iflammatory pathologies, compared to healthy controls. However, clinical entities like testicular torsion and epididymoorchitis could not be distinguished according to these markers.

Inflammatory processes play an important role in the onset and progression of most genitourinary system diseases such as; pelvic inflammatory disease (PID), overian and testisicular cancer, testicular torsion and epididymoorchitis [4, 12, 15].

Since originated from the same embryological background, inflammatory markers may be identical in ovarian and testicular pathologies. In the study of Soysal et al. comparing adnexial pathologies, no statistically significance was shown according to NLR in the diagnostic differentiation of adnexial torsion and overian cyst rupture. Additionally, non-ruptured ovarian cyst group had quantitatively higher NLR values, which is also in correlation to our results [16].

In the study of Gunes et al., reported significances for NLR, PLR and MPV values and evaluated cut off levels, showed total consistency with our torsion group findings. In addition, sensitivity/specifity levels for PLR were found to be in accordance, whereas in contrast to specifity, sensitivity levels for NLR were higher than ours [17].

In a comprehensive study conducted by Yücel et al., using inflammatory markers for the diagnostic differantiation of epididymorchitis and testicular torsion, no statistically significant difference was found between PLR, NLR and MPW values which is in total accordance to our results [13]. However, as against specifity levels, sensitivity levels of NLR and PLR values were found to be higher. Based on the studies showing that hypoxic damage may lead to an increase in inflammation [9], we suggested that the exclusion of patients admitted to the hospital after 6th hour of scrotal pain onset, in Yücel et al. study, may explain this difference.

The study conducted by Bitkin et al., which is similar in terms of sample size, showed correlational results to our findings, according to NLR and PLR values that were higher compared to the control group [12]. However, in contrast to our results, MPV values were found statistically

significant between the epididymorchitis, testicular torsion and control groups. Mean Platelet Volume is commonly affected by inflammatory pathologies, malignancies or chemotherapeutic agents. Therefore, we believe that, the lack of more specifically defined inclusion/exclusion criteria in Bitkin et al. study, might be the source of this difference. In addition to these criteria, the distinct range of patients age, of both studies torsion group, could explain the quantitatively slight difference of sensitivity and specifity levels of NLR values even AUC levels were identical,

Mean Platelet Volume is known as an indirect indicator of platelet activity that differs in certain inflammatory processes and consequently be used in the diagnosis of various inflammatory diseases [18, 19]. Though, there are also studies in which MPV values are high in non-inflammatory urological conditions like erectile dysfunction, testicular torsion or varicocele [20, 21].

In the study of Peretti et al., in contrast to our results, it was found that MPV values are higher in the testicular torsion group compared to the control group, consisting of healthy individuals [22]. Except patient selection, which was as well not particularly specified in this study, that can have an impact as previously described, discrepancies between patients age and sample size, has to be considered as other distinct influential parameters between both studies.

Our study demonstrated some limitations that have to be considered. First, its retrospective nature. Secondly, the relatively limited sample size. Eventually, differentiation of patients according to hospital admission and surgery time, and the lack of acute phase reactants for comparison, can be described as its limitations.

Inflammatory markers, obtained from low-cost routine CBC tests, may be used as adjuant parameters in the diagnose of testicular torsion and/or epididymorchitis. However, to identify the differential diagnostic usefulness of these markers, further prospective studies with specifically defined inclusion/exclusion criteria are required to elucidate the contradictory data of the literature.

Disclosure of conflict of interest

None.

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