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Predictive Blood Parameters in Suspected Isolated Orbital Wall Fracture

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Authors' contributions

This work was carried out in collaboration between all authors. Author Reşat Duman designed the study. Authors Reşat Duman, EÇ and MCS performed the statistical analysis, wrote the protocol and first draft of the manuscript. Authors Reşat Duman and Rahmi Duman managed the analyses of the study. Reşat Duman managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study aimed to study the predictive role of the neutrophil to lymphocyte ratio (NLR) and platelet to lymphocyte ratio (PLR) in discriminating patients with or without orbital wall fracture in the acute period of blunt orbital trauma.
Materials and Methods: Thirty-one patients with orbital wall fracture and 31 patients without orbital wall fracture were enrolled in this comparative retrospective study. Complete blood count measurements including NLR and PLR performed in the acute period were analysed in all patients, and results were compared between 2 groups.
Results: Patients with orbital fracture had significantly higher NLR and PLR compared to patients without fracture (p=0.006, p=0.022).
Conclusions: NLR and PLR performed at acute post-traumatic period may be used as a diagnostic clue to detect an orbital fracture.

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1. INTRODUCTION

Blunt orbital traumas may lead to isolated orbital wall fractures depending on the direction and severity of the trauma [1]. As orbital wall fractures can lead to several complications such as diplopia, enophthalmos, or limited extraocular movement, it's important to detect the fractures in the acute period [2]. Although imaging techniques are widely used to detect fractures, they are not available in all centers, and also in some cases imaging may give suspected results. Thus clinical markers, easy to perform and available in all centers, are still needed to predict the severity of injury in acute cases with blunt trauma and to help in detecting the subgroup with a fracture.

In practice, predicting the severity of the injury is important for planning treatment and follow up modalities of trauma patients, and thus various scoring systems including Glasgow Coma Score, Revised Trauma Score, and Injury Severity Score are used to assess the severity of head trauma [3,4]. In addition, various studies reported that leukocytosis, hypokalemia, and acidosis in peripheral blood analysis might be used as predictive factors of the severity of injury in trauma patients [5-8]. However, to the best of our knowledge, there is no previous study evaluating alterations in the complete blood count (CBC) in cases with isolated orbital trauma. The aim of the present study was to analyze the predictive role of the CBC parameters, including neutrophil to lymphocyte ratio (NLR) and platelet to lymphocyte ratio (PLR), in cases with acute blunt orbital trauma to detect orbital wall fracture.

2. MATERIALS AND METHODS

2.1 Patients

Medical records of 600 patients with facial trauma between January 2015 and February 2017 were retrospectively reviewed. The magnetic resonance (MR) and computerized tomography (CT) imaging records of all patients were reevaluated. Exclusion criteria were defined as follows: 1) Patients with complex facial fractures with orbital fractures (such as the zygoma, temporal bone, alveolar bone of the maxilla, mandibular bone fracture), 2) Patients with a clinical history of any systemic disease including hematological disease, malignancy and recent/chronic infection, 3) Patients under steroid therapy or with a history of recent steroid therapy, 4) Patients followed up in the intensive care unit.

Totally 62 orbital trauma patients with CBC performed within 1 hour after trauma were included in the study. Clinical data including demographic features, initial CT scans records, and presence and location of fracture were noted. The patients were subgrouped into 2 groups: as 31 patients with orbital wall fracture (WF) and 31 patients without orbital wall fracture (WOF).

2.2 Blood Parameters

CBC parameters performed within 1 hour after trauma were evaluated. All blood samples were EDTA based anticoagulated and CBC analysis was performed with a blood analyzer (Beckman Coulter LH 780 [Beckman Coulter, Miami, USA]). Total leucocyte, neutrophil, lymphocyte, platelet numbers were noted, and NLR and PLR were calculated. Results were statistically compared between WF and WOF groups.

2.3 Statistical Analysis

Statistical analysis was performed using SPSS software (version 16; SPSS Inc., Chicago, IL, USA). Distributions of normality of the parameters were checked with the Kolmogorov-Smirnov test. Differences between groups were compared using an unpaired t-test or analysis of variance (ANOVA) for normally distributed variables and a Mann-Whitney U test or Kruskal-Wallis test for non-normally distributed variables. Bivariate correlations were evaluated using the Pearson or Spearman rank correlation coefficient for non-normally distributed variables. P values < 0.05 were considered statistically significant. Receiver operating characteristics curve (ROC) analysis of NLR and PLR for discrimination between patients WF and WOF was performed.

3. RESULTS

The mean age of the 62 patients (47 male/15 female) was 40±18.22 (range 11-83). Age and sex distribution within two groups were similar (p= 0,493 p= 0,812 respectively). In the WF group, the most common fracture location was a lateral orbital wall (16 cases/51.6%), followed by inferior (11 cases/35.4%) and medial orbital wall (4 cases/12.9%). Three patients had multiple wall fractures.

In posttraumatic CBC analysis, total leucocyte number was significantly higher in the WF group (p=0.000). In addition, NLR was significantly higher in WF group (11.34±10.43 versus 2.47±1.21 in WOF group, p=0.000). Similarly, PLR in WF group (201.40±145.55) was significantly higher than that in WOF group (103.65±36.24, p=0.000). Analyzed CBC parameters of 2 groups were given in Table 1.

According to ROC analysis, the best cut-off value of the NLR to distinguish patients WF and WOF was 0,87 with a sensitivity of 90,30 % and a specificity of 51,60 %. In addition, the best cut-off value for PLR was found to be (A sensitivity of 80,60 % and a specificity of 29 %. The ROC analysis and box plot showing of the studied variables are shown in Fig. 1 and 2.

4. DISCUSSION

The present study mainly aimed to study the usability of post-traumatic NLR and PLR in predicting orbital wall fractures in orbital trauma cases. The study findings showed that these markers may be used as clinical markers to differentiate orbital trauma patients WF from that WOF.

Table 1. CBC parameters compared between WF and WOF groups

CBC parameters (Mean ± SD)	WF (N=31 Patients)	WOF (N=31 Patients)	P Values
Total leucocyte number (103/ML)	14,8	9,5	0,338
Total lymphocyte number (103/ML)	1,9	2,8	0,812
Total platelet number (103/ML)	253	252	0,069
NLR	9,75	2,44	0,000
PLR	184,5	103,6	0,000

CBC: Complete blood count; WF: with fracture; WOF: without fracture; NLR: neutrophil to lymphocyte ratio; PLR: platelet to lymphocyte ratio

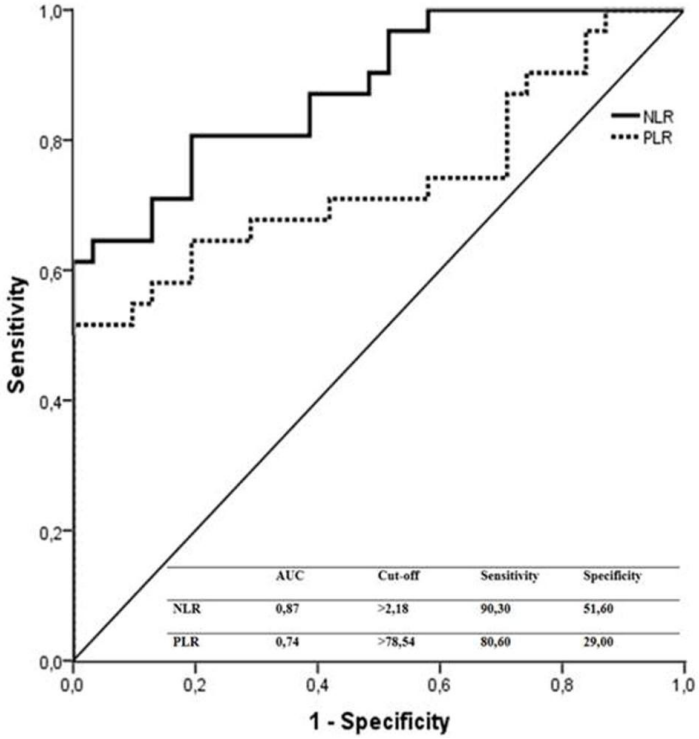

Fig. 1. ROC analysis of NLR and PLR for discrimination between patients WF and WOF
ROC: Receiver operating characteristics curve; WF: with fracture; WOF: without fracture

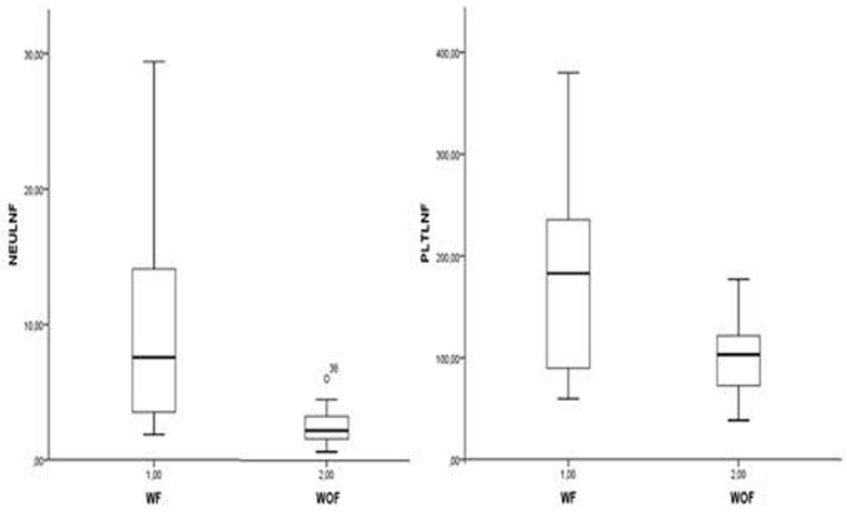

Fig. 2. Boxplot showing NLR and PLR levels in patients with orbital fracture (WF) and without orbital fracture (WOF) group. NLR, neutrophil to lymphocyte ratio; PLR, platelet to lymphocyte ratio

Although imaging facilities are used in evaluating the severity of injury in the post-traumatic period, CBC-a cheap and widely available clinical test may also be used as an adjunctive parameter in trauma patients. Previously various studies investigated the association between head trauma and CBC parameters, and it has been suggested that the inflammatory processes and increase in catecholamine and various cytokine levels after trauma may lead to increase in blood leukocyte levels [9-11]. Some studies suggested that leukocytosis may have a predictive value in assessing the severity of injury in trauma patients [12,13]. In a retrospective study involving 713 blunt trauma patients, Akköse et al. found that white blood cell count was positively correlated with injury severity score [14]. Similarly, Morell et al. in their study of 156 blunt trauma patients showed that leukocytosis was correlated with the severity of trauma [15]. Rovlias and Kotsou in their prospective study of 624 head injury patients showed that white blood cell count was significantly higher in patients with a severe head injury compared to those with minor or moderate injury [16]. Similarly, Santucci et al. found a statistically higher white blood cell count in 279 blunt trauma patients with a significant injury compared to those without injury [17]. In a recent study, Milani et al. showed significant CBC alterations in 50 patients with facial fractures [18]. In consistency with previous studies with trauma patients, we found a positive correlation between total leucocyte number and the severity of injury in cases of orbital trauma. In addition to total white blood cell counts we also firstly showed that NLR and PLR in acute posttraumatic period positively correlated with severity of injury and presence of fracture in cases with orbital trauma. According to our study findings, we suggest that cutoff values of 2,18 for NLR and 78,54 for PLR may be used predictive markers to detect orbital wall fracture in orbital trauma cases.

To the best of our knowledge, this study adds new data to the medical literature suggesting usability of post-traumatic NLR and PLR in orbital trauma cases to predict the presence of orbital wall fracture. The limitations of the present study are retrospective design, the small number of patients included, and lack of repeated CBC analyses in the following post-traumatic hours. In conclusion, we suggest that the NLR and PLR performed within 1 hour after trauma may predict orbital wall fracture and may be used as adjunctive clinical parameters to imaging techniques to assess the severity of the injury.

5. CONCLUSION

NLR and PLR performed at acute postraumatic period may be used as a diagnostic clue to detect an orbital fracture.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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