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Predictive Value of the Neutrophil/Lymphocyte Ratio in Testicular Torsion

Testis Torsiyonunda Nötrofil/Lenfosit Oranının Öngörü Değeri

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Abstract

Objective: The association between blood markers and testicular viability after testicular torsion (TT) is not well known. Here, the role of the neutrophil-to-lymphocyte ratio (NLR) in predicting testicular viability in children with TT was evaluated.

Methods: Clinical data of eighty children younger than 18 years of age who underwent TT between 2018 and 2023 were analyzed. Age, symptom duration, degree of spermatic cord torsion, surgical approach adopted, and hematological parameters including neutrophil, lymphocyte, and C-reactive protein (CRP) levels were obtained. The NLR was calculated.

Results: The median age was 14 (1-17) and the median duration of symptoms was 24 h (1-168 h). Testicular blood flow in color Doppler ultrasonography was absent in 64 patients (81%). During scrotal exploration, 39 patients (49%) underwent orchiopexy and 41 (51%) underwent orchiectomy. Median NLR (2.8 vs 5 p<0.001), and CRP (2.6 vs 27 p<0.001) were higher among patients who underwent orchiectomy. Patients with higher than 3.5 NLR were significantly more likely to undergo orchiectomy (37% vs 63%).

Conclusion: NLR and CRP were significantly associated with testicular viability, and both parameters can be used to predict the outcome of testis in TT.

Keywords: Testicular torsion, pediatric testicular torsion, orchiectomy, orchiopexy, neutrophil/lymphocyte ratio

Öz

Amaç: Bu çalışmanın amacı testis torsiyonu (TT) görülen çocuklarda testiküler canlılığı tahmin etmede nötrofil lenfosit oranının (NLR) rolünün değerlendirilmesidir.

Yöntem: 2018-2023 yılları arasında TT nedeniyle ameliyat edilen 18 yaş altındaki 80 çocuk çalışmaya dahil edildi. Yaş, semptom süresi, spermatik kord torsiyonunun derecesi, uygulanan cerrahi yaklaşım ve başvuru anında görülen C-reaktif protein (CRP), mutlak nötrofil ve lenfosit değerleri incelendi, NLR hesaplandı.

Bulgular: Ortalama yaş 14 (1-17) ve semptom süresi 24 saat (1-168 saat) idi. Renkli Doppler ultrasonografide 64 hastanın (%81) testiküler kan akımı yoktu. Skrotal eksplorasyon sırasında, 39 hastaya (%49) orşiopeksi, 41 hastaya (%51) orşiektomi yapıldı. Orşiektomi yapılan hastalarda median NLR (2,8 vs 5, p<0,001) ve CRP (2,6 vs 27, p<0,001) daha yüksekti. NLR'si 3,5'in üzerinde olan hastalara orşiektomi yapılma sıklığı anlamlı oranda daha yüksekti (%37 vs %63).

Sonuç: NLR ve CRP, testiküler canlılık ile anlamlı şekilde ilişkilendi ve her iki parametre de TT'de testiküler dokunun canlılığını değerlendirmede kullanılabilir.

Anahtar Kelimeler: Testis torsiyonu, çocuklarda testis torsiyonu, orşiektomi, orşiopeksi, nötrofil lenfosit oranı

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Introduction

Testicular torsion (TT) is a common cause of acute scrotum in children that requires urgent care with prompt diagnosis with 3.8 per 10,000 incidence rates in males younger than 18[1]. TT occurs when the spermatic cord twists around its own axis, resulting in the initial obstruction of venous blood flow. Subsequently, arterial obstruction may develop, potentially leading to the loss of the affected testis[2].

Surgical intervention due to acute TT may lead to either the preservation of the testis through detorsion and orchiopexy or testicular loss via orchiectomy due to irreversible damage. A high index of suspicion and rapid and accurate diagnosis with timely exploration are essential to reduce testicular loss. In general, detorsion performed within the first 8 h of symptom onset can significantly result in higher chances of testicular salvage, whereas duration of symptoms more than 12 hours mostly results with orchiectomy[3].

Numerous publications suggest that hematologic parameters such as absolute neutrophil and lymphocyte counts, platelets, and certain inflammatory markers may serve as valuable tools in diagnosis of TT[4]. Recent research has highlighted the utility of mean platelet volume, platelet-to-lymphocyte ratio, and neutrophil-to-lymphocyte ratio (NLR) as indicators of inflammation, with specific studies investigating their potential for aiding in the diagnosis of TT[5]. Herein, we aimed to demonstrate the practical utility of NLR in assessing the outcomes of TT. Our objective was to determine whether the NLR can serve as a predictive marker for gaging the severity of the testicular condition in cases of torsion.

Materials and Methods

In this study, we reviewed the electronic medical records of a cohort comprising 80 boys under the age of 18 who underwent scrotal exploration for TT at our medical center between 2018 and 2023. The inclusion criteria were TT confirmed by surgery. Newborns with TT and children with organ dysfunction or hematologic disorders were excluded from this study. The information collected included patient age in years, duration of symptoms (time between the onset of symptoms and the medical care), side of torsion, degree of spermatic cord twisting, type of surgery, and hematological parameters. All patients had a complete blood count (CBC) before scrotal exploration. The white blood count, absolute neutrophil count, and absolute lymphocyte count were obtained. These values were subsequently used to calculate the NLR. In addition, if available, we collected C-reactive protein (CRP) values as part of our data collection process. These values were then used to calculate the NLR. CRP values were also collected if available.

During surgery, the affected testis was carefully detorted and its viability was assessed. In cases where there was concern about testicular viability, fasciotomy of the tunica albuginea was performed for fresh bleeding, and the testis was enveloped in warm, saline-soaked gauze for 20 min and then reevaluated. In the cases where the testis was determined to be non-viable, orchiectomy was performed. For all patients, orchiopexy was performed on the contralateral testis. The patients were divided into two groups depending on the outcome of surgery.

The study was approved by the University of Health Sciences Turkey, İzmir Tepecik Education and Research Hospital's Non-Interventional Research Ethics Committee (approval no.: 2023/11-01, date: 21.12.2023).

Statistical Analysis

Data were analyzed using IBM SPSS (Chicago, IL, USA). Kolmogorov-Smirnov tests were used to determine whether the data had normal distributions. For data with a non-normal distribution, comparison between the groups was performed using the non-parametric Mann-Whitney U test. All data were non-normally distributed; and are presented as a median (minimum-maximum). Spearman's correlation test was used to examine the relationship between the duration of symptoms and NLR. Receiver operating characteristic (ROC) curve analysis was used to assess the area under the curve (AUC) and identify optimal cut-off values. The level of significance was taken as $p<0.05$.

Results

In total, data from 80 children were analyzed for this study. The median age was 14 (1-17) and the median duration of symptoms was 24 h (1-168 h). Testicular blood flow in color Doppler ultrasonography (CDUS) was absent in 64 patients (81%). Children were classified into two groups. The orchiopexy group included 39 children treated with detorsion and orchiopexy, and the orchiectomy group included 41 children treated with orchiectomy due to TT. There was no statistically significant difference between the groups in terms of age and side and blood flow in CDUS. The duration of symptoms, NLR, and CRP levels were significantly different between the orchiopexy and orchiectomy groups (Table 1).

When the correlation between the duration of symptoms and NLR values was further evaluated, no statistically significant association was found within each group (orchiectomy; p=0.047 vs. orchiopexy; p=0.206).

The ability of NLR to predict testicular viability in TT was further evaluated using a ROC curve. The AUC was 0.748. The AUC-ROC was significantly higher than 0.5 (p=0.008; p<0.05) (Figure 1). Patients with NLR higher than 3.5 were significantly more likely to undergo orchiectomy (37% vs. 63%). The sensitivity, specificity, positive predictive value, and negative predictive value of NLR in identifying patients with non-viable testes who underwent orchiectomy were 63%, 72%, 63.4%, and 66.7%, respectively.

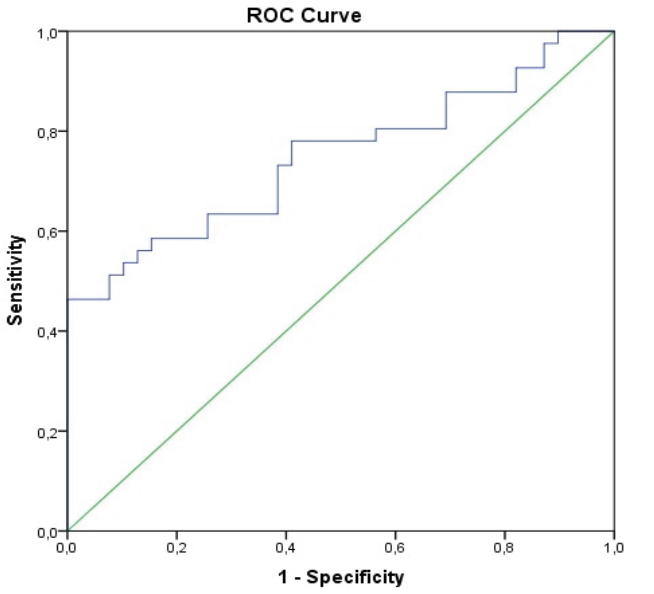

Figure 1. The area under the ROC curve for NLR to predict testicular viability was significantly higher than 0.5

ROC: Receiver operating characteristic, NLR: Neutrophil-to-lymphocyte ratio

Discussion

TT is a urological emergency that may lead to testicular ischemia and even testicular necrosis if not diagnosed and promptly treated. The survival rate of the testis after TT mainly depends on the degree of torsion and duration of symptoms[6]. The European Association of Urology's Pediatric Urology guidelines state that the duration of symptoms and the degree of cord twisting are the most significant predictors of the early salvage rate of the testis[7]. performing detorsion within the first 8 h of symptom onset has a substantial impact on salvaging the affected testis[8].

Although the role of CDUS in the diagnosis of TT is undisputable, its ability to differentiate testicular viability ahead of surgical exploration is limited[9]. Despite its high sensitivity and specificity (up to 97%), both false-negative and false-positive results still occur[10]. In our study, we found no substantial difference in CDUS findings between the orchiectomy and orchiopexy groups. The only differentiator between the two groups was preoperative inflammatory markers.

In recent years, various studies have focused on a range of hematological parameters, examining their relevance in predicting the risk of TT. In addition, acute phase reactants such as CRP and erythrocyte sedimentation rate were reported to increase in TT[11]. A promising link between hematological

Table 1. Baseline characteristics of children who underwent scrotal exploration for testicular torsion

Variables	Orchiopexy (n=39)	Orchiectomy (n=41)	p-value
Age (years)	14 (5-17)	14 (1-17)	0.730
Side			
Left	20 (51.3%)	27 (65.9%)	0.256
Right	19 (48.4%)	14 (34.1%)	
Duration of torsion (h)	24 (1-72)	72 (8-168)	<0.001
Blood flow in color Doppler US			
Present	8 (20.5%)	7 (17.1%)	0.781
Absent	31 (79.5%)	33 (82.9%)	
N/L ratio	2.8 (0.5-5.7)	5 (1.1-20)	<0.001
CRP	2.6 (0.2-44)	27 (0.9-375)	<0.001

Continuous data were presented as median (minimum-maximum), categorical data were presented as number (percent).
US: Ultrasonography, N/L: Neutrophil-to-lymphocyte, CRP: C-reactive protein

parameters and the prediction of testicular viability in TT has been investigated by various researchers[12,13]. These parameters can be readily established through routine CBC analysis conducted before surgery. Furthermore, they are cost-effective, easily calculable, pragmatic, and widely employed in clinical practice. In a clinical cohort of male adult patients investigating various hematological biomarkers as potential indicators of testicular viability in TT, Güneş et al.[14] reported a significant relationship between scrotal tenderness, NLR, and platelet counts. Bitkin et al.[15] reported that NLR can be used in the differential diagnosis of TT and epididymitis with 70.1% sensitivity and 76.9% specificity. In a similar study conducted on 60 TT patients, 38 underwent orchiectomy and 22 underwent orchiopexy Jang et al.[16] revealed that the duration of symptoms determines the viability of testis notably, NLR emerged as an independent predictor of testis survival, particularly in cases where surgical correction occurred with only a marginal delay in diagnosis. This identifies NLR as a potential indicator for assessing testicular viability in TT[16].

The results of this study have significant clinical relevance. Both NLR and CRP were significantly higher in TT resulting in testicular loss. Here, NLR demonstrated 63% sensitivity and 72% specificity in predicting the viability of testis in TT. These findings suggest the possible use of NLR in children with TT to determine the viability of torted testis before surgery.

Study Limitations

There are several limitations in this study, mainly due to the single-centered retrospective design. The sample size also was not large. Further multicenter randomized prospective studies with large sample sizes should be conducted to better assess the value of NLR in determining testicular viability in TT.

Conclusion

Identifying a reliable marker for predicting the risk of orchiectomy following acute TT is crucial for improving patient and parental counseling during surgical intervention. NLR has emerged as a promising and reliable predictor of testicular viability in children with TT. Incorporating NLR into the assessment protocol may enhance the precision of prognostic information provided to patients and their parents, thus facilitating more informed decision-making during the critical period of surgical intervention.

Ethics

Ethics Committee Approval: The study was approved by the University of Health Sciences Turkey, İzmir Tepecik Education and Research Hospital's Non-Interventional Research Ethics Committee (approval no.: 2023/11-01, date: 21.12.2023).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: E.B.Ç.K., Concept: E.B.Ç.K., Design: E.B.Ç.K., M.Z.K., Data Collection or Processing: E.B.Ç.K., M.Z.K., Analysis or Interpretation: E.B.Ç.K., M.Z.K., Literature Search: E.B.Ç.K., Writing: E.B.Ç.K.

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