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Erkek Üreme Sağlığı

Can the HALP score predict orchiectomy following testicular torsion?

HALP skoru testis torsiyonu sonrası orşiektomiyi öngörebilir mi?

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ABSTRACT

OBJECTIVE: Testicular torsion (TT) is a severe pediatric emergency that can lead to organ loss. The prognostic value of the hemoglobin, albumin, lymphocyte, and platelet (HALP) score has been demonstrated in various vascular and inflammatory diseases and malignancies. Given the role of inflammation and reperfusion injury in TT, this study aimed to investigate the predictive value of the HALP score for orchiectomy in TT cases, comparing it with other hematologic parameters.

MATERIAL and METHODS: This retrospective study included data from patients aged 10–25 years who were diagnosed with TT and underwent surgery between January 2005 and June 2024. Demographic data, hematologic parameters, and other preoperative data were recorded. The HALP score, along with other hematologic parameters indicative of inflammation, was evaluated for its ability to predict orchiectomy.

RESULTS: The patients with TT were divided into two groups: those who underwent detorsion or orchiopexy (Group 1, n=140) and those who underwent orchiectomy (Group 2, n=47). The groups had similar mean ages (p=0.939). While there was no significant difference in HALP scores between the groups (p=0.191), the monocyte-lymphocyte ratio showed a significant difference (p=0.046). Multivariable analysis indicated that the neutrophil-lymphocyte ratio and platelet-lymphocyte ratio were predictive of orchiectomy.

CONCLUSION: Our findings showed that the HALP score did not successfully predict orchiectomy following TT. However, other hematologic inflammatory markers may have predictive value for orchiectomy.

Keywords: HALP score, orchiectomy, testicular torsion

ÖZ

AMAÇ: Testis torsiyonu (TT), organ kaybıyla sonuçlanabilen ciddi bir pediatrik acildir. Vasküler ve enflamatuvar hastalıklarda, malignitelerde HALP (hemoglobin, albümin, lenfosit ve trombosit) skorunun prognostik değeri birçok çalışmada gösterilmiştir. İnflamasyon ve reperfüzyon hasarının rol oynadığı bilinen TT'nda HALP skorunun orşiektomiyi öngörü değerini, diğer hematolojik parametrelerle karşılaştırarak araştırmayı amaçladık.

GEREÇ ve YÖNTEMLER: Ocak 2005-Haziran 2024 tarihleri arasında TT tanısı koyularak cerrahi uygulanan 10–25 yaş aralığındaki hastaların verileri retrospektif olarak incelendi. Demografik veriler, hematolojik parametreler ve diğer ameliyat öncesi veriler kaydedildi. HALP skoru, diğer enflamasyonu gösteren hematolojik parametrelerle birlikte orşiektomiyi öngörmesi açısından değerlendirildi.

BULGULAR: TT hastaları detorsiyon/orşiopeksi uygulananlar (Grup 1, n=140) ve orşiektomi uygulananlar (Grup 2, n=47) olarak gruplara ayrıldı ve sonuçlar karşılaştırıldı. Gruplar arası yaş ortalamaları benzerdi (p=0,939). HALP skorları arasında anlamlı farklılık izlenmezken (p=0,191), monosit-lenfosit oranı (MLR) iki grup arasında anlamlı olarak farklıydı (p=0,046). Multivaryant analizlerde nötrofil-lenfosit oranı (NLR), platelet-lenfosit oranı (PLR) değerlerinin orşiektomiyi öngördüğü izlendi.

SONUÇ: Sonuçlarımız HALP skorunun TT sonrasında orşiektomiyi başarılı şekilde tahmin etmediğini gösterdi. Ancak diğer hematolojik enflamasyon belirteçleri orşiektomiyi öngörebilir.

Anahtar Kelimeler: HALP, orşiektomi, testis torsiyonu

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INTRODUCTION

Testicular torsion (TT) is a medical emergency affecting approximately 1 in every 4.000 men under 25 years of age and accounts for up to 25% of acute scrotal pain in the pediatric population.[1] When testicular reperfusion is compromised, patients may experience ischemic necrosis at rates ranging from 32% to 64%, leading to permanent testicular damage and subsequent orchiectomy.[2] The irreversible nature of testicular loss can result in long-term fertility issues and psychological trauma; therefore, accurate diagnosis and treatment planning are crucial.[3] Given these considerations, the ability to predict which patients

may require orchiectomy is essential for both surgeons and Physicians Who perform. The initial examination on patients.[4]

Several studies have explored predictive factors for orchiectomy in cases of TT, identifying variables such as the degree of torsion, increasing age, and, most significantly, the duration of symptoms.[5] However, relying solely on these variables does not sufficiently meet the clinical decision-making needs. Patients with brief symptomatology may still require orchiectomy, whereas those with relatively prolonged symptoms may need to undergo detorsion or orchidopexy.[6]

In the literature, hemoglobin, albumin, lymphocyte and platelet (HALP) score has been reported to have prognostic value in various solid tumors.[7] In addition, the HALP score predicts organ loss due to reperfusion injury in vascular events and mortality in inflammatory diseases.[8,9] As TT is inherently an inflammatory process, hematological parameters indicative of systemic inflammation have been extensively investigated for their utility in differential diagnosis and predicting patients who may require orchiectomy; however, the literature on this subject remains insufficient.[10] Recently, the application of inflammatory and hematological scoring systems similar to HALP in the differential diagnosis of TT has gained popularity.[11]

The purpose of this retrospective report was to evaluate the predictive value of HALP score in predicting the need for orchiectomy in TT cases.

MATERIAL and METHODS

Following approval by the local ethics committee (number: 2024/285), we retrospectively reviewed data from patients <25 years of age who underwent surgery for TT from January 2005 to June 2024. Upon diagnosis, all cases underwent either orchidopexy or orchiectomy. Patients with comorbidities, history of chronic drug use, patients <1 year of age, patients >25 years of age and patients with missing data were excluded.

Demographic characteristics, presenting symptomatology, preoperative imaging, and laboratory test data were collected from patient files. The duration from symptom onset to surgery was defined as "symptom duration." Parameters such as the monocyte-to-lymphocyte ratio (MLR), neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and the HALP score was measured according to preoperative CBC results. The HALP score was derived using the formula, hemoglobin (g/L) × albumin (g/L) × lymphocytes (/L)/platelets (/L).[12] Data obtained from Doppler ultrasonography (D-USG) were recorded, including the degree of TT and the type of surgery performed. After detorsion, a hot cloth was applied to the testicle for about 20 minutes. Fixation was applied if testicular reperfusion was compromised or fresh bleeding was observed at the incision site. Once adequate perfusion was confirmed, the testis was placed in the scrotum, and subsequent fixation (i. e., orchidopexy) was performed. Orchiectomy was performed in cases of necrotic testicles. Routine fixation was applied to the contralateral testis. Drains were not used in cases. Cases were classified into two groups according to the type of operation applied: Group 1 included those who underwent surgical detorsion and orchidopexy and Group 2 included those who underwent orchiectomy.

Statistical Analysis

Statistical analyses were performed with IBM Statistical Package for Social Sciences (SPSS) program version 25 (IBM Corp., Armonk, NY, USA). Data were presented as mean ± standard deviation, median, interquartile range (IQR), or frequency (%) values. The distribution of continuous variables was evaluated using the Shapiro-Wilk test. Mann-Whitney U test was used to compare continuous variables according to their distributions. The chi-square test (with continuity correction, Fisher's exact test or Pearson chi-square test) was used to analyze categorical variables. Receiver operating characteristic (ROC) curve analysis with area under the curve (AUC) was used to identify optimum cut-off values for various scoring indices related to orchiectomy. Optimal cut-off values were selected based on the maximum sensitivity and acceptably high specificity, as well as positive and negative predictive values. Area under the curve values were categorized as good (0.8–1), moderate (0.7–0.8), fair (0.6–0.7), and poor (0.5–0.6). Area under the curve analysis for scoring systems was undertaken using the MedCalc (trial version 22.030) software. Binary logistic regression was used to determine risk factors for orchiectomy. Multivariable logistic regression models were constructed using the stepwise backward Wald method. A p-value of <0.05 was considered statistically significant.

RESULTS

A totally 187 cases were enrolled in the research, of whom 140 (74.9%) were treated with orchiopexy (Group 1) and 47 (25.1%) were treated with orchiectomy (Group 2). The mean age of the entire cohort was 15.1±3.7 years, with no statistically different age between the two groups. Both groups

Table 1. Demographic and clinical features of the patients

Parameters (mean ± SD)	*Group 1 (Orchiopexy) (n, %) 140 (74.9)*	*Group 2 (Orchiectomy) (n, %) 47 (25.1)*	*p-value*
Age (year)	15±3.6	15.1±3.9	0.939[+]
Side (n, %)			
Left	88 (62.9)	31 (66)	0.836[*]
Right	52 (37.1)	16 (34)	
Doppler result *(n, %)*			
No blood flow	101 (72.1)	34 (72.3)	0.208[**]
Equal blood flow	8 (5.7)	0 (0)	
Decreased blood flow	31 (22.1)	13 (27.7)	
Torsion degree	251.6±159	463.3±153.6	<0.001[+]
Symptom duration (*hours*)	8.1±10.2	83.1±143.2	<0.001[+]
WBC count (x10³ µl)	11.8±3.4	12.2±3	0.393[+]
Monocyte count	826±372.2	919.6±341.2	0.097[+]
Lymphocyte count	1904.3±586.4	1813.8±523.9	0.424[+]
Neutrophil count (x10³ µl)	9.1±3.3	9.6±3.1	0.215[+]
Platelet count (x10³ µl)	286.2±73.8	292.7±69	0.370[+]
MLR	0.5±0.2	0.6±0.2	0.046[+]
NLR	5.3±2.7	5.8±2.4	0.083[+]
PLR	163±60.1	175.6±68.5	0.224[+]
MCV	85.6±4.9	85.7±5.5	0.841[+]
MPV	8.6±1.4	8.7±1.2	0.474[+]
Hemoglobin	142.9±13.3	141.8±13.2	0.365[+]
Albumin	48.3±7.1	48±7.7	0.798[+]
Total protein	71.3±5.4	71.4±6.2	0.998[+]
HALP score	48.7±21.7	43.8±17.5	0.191[+]

SD: standard deviation, **WBC:** white blood cell, **MLR:** monocyte-to-lymphocyte ratio, **NLR:** neutrophil-to-lymphocyte ratio, **PLR:** platelet-to-lymphocyte ratio, **MCV:** mean corpuscular volume, **MPV:** mean platelet volume, **HALP:** hemoglobin, albumin, lymphocyte, and platelet.
[+]Mann-Whitney U test, [*]continuity correction test, [**]Pearson chi-square test.

Table 2. Univariable and multivariable logistic regression analyses of risk factors for orchiectomy

	Univariable		*Multivariable*	
Variables	OR (95% CI)	p value	OR (95% CI)	p-value
Torsion degree	0.999 (0.998–1.000)	0.006	1.018 (1.008–1.027)	<0.001
Symptom duration (hours)	1.014 (1.003–1.025)	0.014	1.297 (1.148–1.466)	<0.001
MLR	0.172 (0.089–0.333)	<0.001	0.005 (0.000–1.428)	0.066
NLR	0.855 (0.807–0.906)	<0.001	0.191 (0.054–0.669)	0.010
PLR	0.994 (0.993–0.996)	<0.001	1.027 (1.002–1.052)	0.037
HALP score	0.978 (0.971–0.985)	<0.001		

OR: odds ratio, CI: confidence interval, MLR: monocyte-to-lymphocyte ratio, NLR: neutrophil-to-lymphocyte ratio, PLR: platelet-to-lymphocyte ratio, HALP: hemoglobin, albumin, lymphocyte, and platelet.

were similar in terms of torsion side and D-USG findings. Symptom duration and degree of torsion were statistically less in Group 1 versus Group 2 (p <0.001). Monocyte-to-lymphocyte ratio showed a low level of significant difference between the two groups (p=0.046). No meaningful differences were found in white blood cell count, monocyte count, lymphocyte count, neutrophil count, platelet count, NLR, PLR, mean corpuscular volume, mean platelet volume, hemoglobin, albumin or total protein levels. Hemoglobin, albumin, lymphocyte and platelet scores were also similar between the two groups. Table 1 shows the demographic and clinical data of the cases.

Pathological examination of the orchiectomy specimens revealed hemorrhagic infarction in the testicular and epididymal tissues of all patients, with no neoplastic findings in any case.

Univariable analysis revealed that the HALP score was a non-significant predictor of orchiectomy. According to multivariable logistic regression analysis, torsion degree, symptom duration, NLR, and PLR were significant predictors of orchiectomy rates. Monocyte-to-lymphocyte ratio showed low significance in multivariable logistic regression analysis (Table 2). Cut-off values and ROC analysis results

Table 3 Predictive performance of the investigated parameters

Scores	*Cut-off value*	*AUC (95% CI)*	*p-value*	*Sensitivity*	*Specificity*	*PPV*	*NPV*
HALP	≤59.95	0.564 (0.49–0.64)	0.170	0.91	0.23	0.28	0.89
MLR	>0.39	0.596 (0.52–0.67)	0.037	0.77	0.44	0.32	0.85
NLR	>5.3	0.585 (0.51–0.66)	0.076	0.57	0.62	0.34	0.81
PLR	≥180	0.559 (0.48–0.63)	0.230	0.45	0.70	0.34	0.79

AUC: area under curve, CI: confidence interval, PPV: positive predictive value, NPV: negative predictive value, HALP: hemoglobin, albumin, lymphocyte, and platelet, MLR: monocyte-to-lymphocyte ratio, NLR: neutrophil-to-lymphocyte ratio, PLR: platelet-to-lymphocyte ratio.

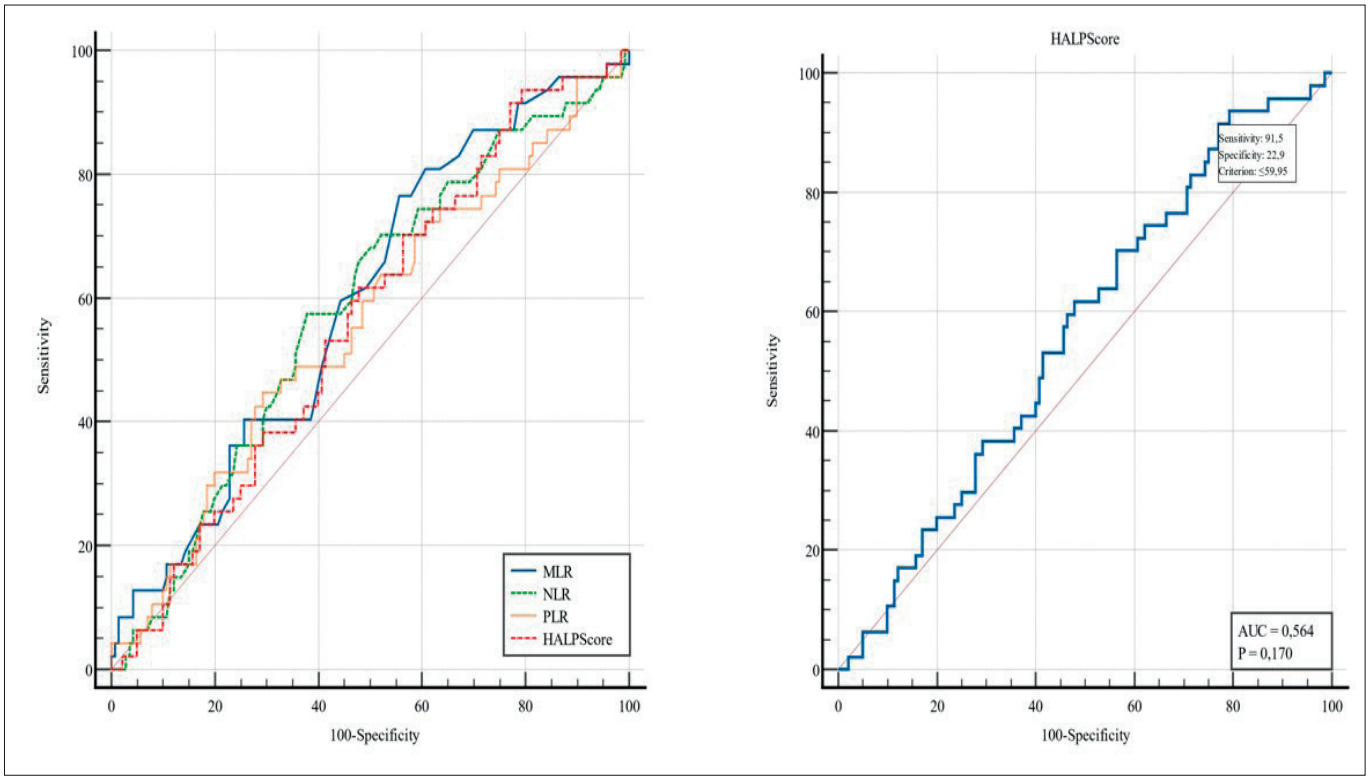

Figure 1. Receiver operating characteristic (ROC) curve analysis of monocyte-lymphocyte ratio (MLR), neutrophil-lymphocyte ratio (NLR), platelet-lymphocyte ratio (PLR), and hemoglobin, albumin, lymphocyte, and platelet (HALP) score in predicting orchiectomy

for MLR, NLR, PLR, and HALP scores are presented in Table 3 and Fig. 1. The ROC curve analysis indicated that MLR was a poor predictor of orchiectomy.

DISCUSSION

The HALP score, initially defined by Chen et al., reflects patients' nutritional, immune, and systemic inflammatory status.[12] This score has been validated as a reliable negative predictive marker for outcome in a variety of cancers.[13] Guo et al. demonstrated the prognostic utility of HALP score in cases with advanced prostate cancer undergoing cytoreductive radical prostatectomy.[14] In a study evaluating bladder cancer recurrence in patients with upper urinary tract cancer, low HALP scores were associated with advanced pathological stages and increased recurrence risk.[15] Peng et al. also verified the prognostic value of HALP score in bladder cancer cases undergoing radical cystectomy.[16]

In addition to malignancy, the HALP score has been tested in non-cancerous conditions with inflammatory and infectious components, such as IgA nephropathy, acute stroke, heart failure, and Fournier's gangrene.[17–19] Inflammatory events contribute to the initiation and progression of many genitourinary diseases, especially pelvic inflammatory disease, ovarian and testicular cancers, and inflammatory markers are known to increase in TT cases due to hypoxic tissue damage following reduced blood flow.[20] While various hematologic and inflammatory parameters, such as NLR, PLR, and mean platelet volume, have been studied for their predictive roles in orchiectomy in TT cases[21], no studies in the literature have yet evaluated the HALP score in this context. The aim of this study was to determine whether the HALP score, which can be estimated at low cost from CBC analysis, can predict orchiectomy in TT cases.

The orchiectomy rate in TT cases is approximately 40%.[5] Given the risk of complications, such as infection and antisperm antibody-mediated infertility, accurate preoperative planning is essential in cases of necrotic testis.[3] In agreement with findings, prior reports have also reported that symptom duration and degree of torsion are important predictors of orchiectomy in TT.[11]

According to multivariate logistic regression analysis, Yilmaz et al. found that monocyte count was the only meaningful parameter in predicting testicular salvage and survival in patients with TT.[22] In a retrospective study including 61 orchiopexy and 27 orchiectomy cases, Merder et al. demonstrated that monocyte count predicted testicular viability.[23] A large-scale study in 2022 similarly found a significant association between monocyte count and testicular viability.[6] Similary to monocyte function, a report by Bedel et al. showed that MLR had a sensitivity of 67.1% and a specificity of 75% for TT prediction versus controls.[24] In a study with a relatively larger patient cohort, Eksi et al. argued that while monocyte count predicted testicular viability, MLR did not predict orchiectomy.[25] Our study revealed that MLR was predictive of orchiectomy following TT, but no similar association was found between monocyte count and orchiectomy.

Gunes et al. reported significantly high sensitivity and specificity levels for NLR in both diagnosing TT and assessing testicular viability.[26] Yucel et al. determined that NLR values had a sensitivity of 63–86% and specificity of 97–100% for TT diagnosis, comparable to D-USG.[10] Jang et al. demonstrated that NLR independently predicted testicular survival with appropriate surgical intervention, especially in patients with delayed diagnosis.[27] Consistent with the literature, our multivariable analysis also identified NLR as a predictor of orchiectomy.

The literature presents mixed findings regarding PLR as a predictor of TT diagnosis and orchiectomy. One study reported that PLR had 51% sensitivity and 89% specificity for TT diagnosis[26], while another retrospective study of 300 patients found PLR to be statistically non-significant for predicting orchiectomy following torsion.[25] In our study, PLR was a predictive factor for orchiectomy in subgroup analyses.

Despite the importance of similar inflammatory parameters in predicting orchiectomy, the HALP score did not differ statistically between Group 1 and Group 2 (p=0.191). Furthermore, the multivariable analyses revealed no significant p-value for the HALP score. At a cut-off value of ≤59.95, the HALP score had an AUC (95% CI) value of 0.564, indicating poor predictive performance.

The strengths of this study include its rigorous inclusion and exclusion criteria, high patient count relative to similar studies, and extended study period. However, the retrospective design represents a limitation. Furthermore, the decision between orchiopexy and orchiectomy seems to have been surgeon-dependent, which introduces an additional limitation.

CONCLUSION

Despite growing knowledge on the pathophysiology, diagnosis, and treatment of TT, it remains a urological emergency that can result in organ loss. In this study, no difference was found among orchiopexy and orchiectomy groups in terms of HALP scores. There was also no significant relationship between HALP score and orchiectomy. However, to our knowledge, this study is important as it is the initial report in the literature investigating the potential role of HALP score in TT prognosis. We think that more extensive research should be done on this topic in the future.

Ethics Committee Approval
The study was approved by Bakirkoy Dr. Sadi Konuk Training and Research Hospital Ethics Committee. (date and number of approval: 07.10.2024/2024/285).

Peer-review
Externally peer-reviewed.

Conflict of Interest
No conflict of interest was declared by the authors.

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