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Original Article UROLOGY

Investigation of blood parameters as predictors in diagnosing acute scrotum

Bilgehan Demir,[1] Suleyman Nogay,[1] Turgut Dolanbay,[1] Muhammed Eyyub Polat,[1] Ender Akdemir[2]

[1]Department of Emergency Medicine, Malatya Turgut Ozal University Faculty of Medicine, Malatya, Turkiye
[2]Department of Urology, Malatya Turgut Ozal University Faculty of Medicine, Malatya, Turkiye

ABSTRACT

OBJECTIVE: Acute Scrotum (AS) is defined as pain associated with swelling and redness of the scrotum. This study investigates the hemogram and C-Reactive Protein (CRP) values obtained from patients diagnosed with AS, based on the hypothesis that blood parameters can be used as biomarkers in the diagnosis of Testicular Torsion (TT). The aim was to evaluate the predictability of these parameters in diagnosing AS in both pediatric and adult age groups.

METHODS: Demographic data and blood parameters including Hemoglobin (Hb), Platelet (PLT), CRP, and White Blood Cell (WBC) levels of patients who presented to our Emergency Department with the diagnosis of AS (TT, epididymitis, varicocele) and received medical and surgical treatment were analyzed. The importance of these parameters in diagnosis was assessed.

RESULTS: A total of 26 patients were included in the study. The mean age of the cases was 15.8±3.6 years. 20 of the patients (76.9%) were in the pediatric age group, while 6 (23.1%) were in the adult age group. 93.1% (27) of the cases were unilateral, while 6.9% (2) had bilateral acute scrotum symptoms. The highest incidence of cases occurred in spring with 9 cases (31%), followed by winter and summer with 7 cases each (24.1%), and autumn with 6 cases (20.7%). Significant differences in age, platelet, and hemoglobin levels were observed between the pediatric and adult age groups.

CONCLUSION: In conclusion, this study highlights significant age-related differences in the diagnosis and treatment of AS. The higher requirement for surgical intervention in pediatric patients further emphasizes the importance of early diagnosis and timely intervention. However, further studies with larger sample sizes are needed to validate these findings and better understand the etiological differences. Additionally, a more specific analysis of blood parameters in subgroups (such as epididymitis, orchitis, TT) under the term "acute scrotum" may contribute to the literature.

Keywords: C-Reactive Protein; infertility; testicular torsion; hemoglobin.

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Acute Scrotum (AS) is defined as pain accompanied by swelling and redness of the scrotum. The most common causes of AS include torsion of intrascrotal appendages, epididymitis, testicular torsion (TT) and idiopathic scrotal edema. The primary goal in the management of AS is to establish an accurate diagnosis in a timely manner without jeopardizing the viability of the affected testis. In this context, TT is a condition that requires emergency intervention. To ensure an accurate and rapid diagnosis, a thorough medical history, physical examination, and diagnostic imaging when necessary are crucial. The similarity of clinical findings among different etiological causes, the presence of excessive tenderness in the scrotal region and ethical considerations may pose challenges during clinical examination [1–3].

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Correspondence: Bilgehan DEMIR, MD. Malatya Turgut Ozal Universitesi Tip Fakultesi, Acil Tip Klinigi, Malatya, Turkiye.
Tel: +90 505 700 46 10 e-mail: bilgehan.demir@ozal.edu.tr

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TT results from the twisting of the spermatic cord and occurs in 10–15% of AS cases [4]. Additionally, it has been reported that approximately one-third of cases may present with atypical clinical findings [3]. A delay of four to eight hours in treatment can lead to permanent ischemic damage to the testis, which may result in fertility issues or, in some cases, necessitate orchiectomy [5]. In recent years, an increase in the incidence of acute epididymitis (AE) has been observed, accounting for 10–71% of all AS cases [2].

Scrotal edema is usually one of the initial signs of AS and develops suddenly, spreading rapidly. Localized redness is generally seen along with edema. Edema often begins in one hemiscrotum and gradually extends to the entire scrotum. Redness may extend to the groin (67%), perineum (42%), penis (20%), or suprapubic region. Edema and erythema are fundamental findings in all patients, with local pain accompanying them in 80% of cases. Additionally, in 21% of cases, the disease may recur up to three times without complications [6].

Bozlu and colleagues reported that germ cell loss in TT patients is associated with testicular lipid peroxidation products, nitric oxide (NO) content and myeloperoxidase (MPO) levels [7]. In recent years, oxidative stress has been shown to play a significant role in the damage caused by TT [8].

In this study, based on the hypothesis that blood parameters may serve as biomarkers for the diagnosis of TT, hemogram and C-reactive protein (CRP) values obtained from patients diagnosed with AS were examined. The predictability of these parameters in the diagnosis of pediatric and adult age groups was evaluated.

Highlight key points

- There are age-related variations in the diagnosis and treatment of acute scrotum.
- Early diagnosis and early surgery in acute scrotum are very important
- In our study model, we identified blood parameters that can be used to predict the prognosis of patients with acute scrotum and presented them to the scientific community for evaluation.

MATERIALS AND METHODS

After obtaining ethical approval from the Non-Interventional Ethics Committee of Malatya Turgut Ozal University Faculty of Medicine on (13.03.2025) with protocol number (2025/39), the study was initiated. Our study aimed to determine the significance of demographic data and blood parameters—including Hb (12.2–18.1g/dl), PLT (142–424 10^3/uL), CRP (0–0.5 g/dl) and WBC (4.6–10.2 10^3/uL) of patients presenting to the Emergency Department of Malatya Training and Research Hospital with an AS diagnosis (TT, epididymitis, varicocele) who received medical and surgical treatment. Biochemical markers were measured using the CRP kit on the About device in our hospital's biochemistry laboratory. Hemogram parameters were also measured in our hospital's biochemistry laboratory using the SYSMEX XN-1000 hemogram device and Cell Pack DST, DCL, WNR, WDF, and SLS Lysercell kits. A total of 45 patient data were accessed, and 29 patients who met the inclusion and exclusion criteria were included in the study.

While designing our study, we acted in accordance with the Helsinki Declaration.

Inclusion Criteria

1. Patients who applied to the emergency department with complaints of acute scrotum (TT, epididymitis, orchitis, varicocele) in the 0–18 age groups (pediatric) and 18 age groups (adult).
2. Patients whose diagnosis of acute scrotum was supported by physical examination and/or ultrasonography.
3. Those whose hemogram (Hb, WBC, PLT) and CRP values were fully recorded at the time of application.
4. Patients whose full data set could be accessed through the Hospital Information Management System (HIMS).

Exclusion Criteria

1. Patients with missing hemogram and/or CRP data.
2. Patients receiving anticoagulant, immunosuppressive or drug therapy that may affect systemic inflamation.
3. Patients with known hematological disease (e.g. leukemia, anemia, thrombocytopenia, etc.).
4. Patients experiencing scrotal complaints due to a cause other than acute scrotum (e.g. trauma, tumor, inguinal hernia, etc.).
5. Patients who refused hospital follow-up or treatment and were discharged voluntarily.

Table 1. Presentation of parametric and non-parametric

	Mean±SD	Median–IQR (25–75%)
Hb (g/dL)	14.9±1.3	
PLT (10^3/uL)	280.6±60.4	
WBC (10^3/uL)		10.2 (8.2–12.4)
CRP (mg/dl)		0.2 (0.2–0.6)

SD: Standard deviation; IQR: Interquartile range; Hb: Hemoglobin; PLT: Platelet; WBC: White blood cell; CRP: C-reactive protein.

Statistical Analysis

The findings obtained in the study were evaluated using IBM SPSS Statistics 27 software (Newyork, USA) for statistical analyses. The normal distribution suitability of the parameters was assessed using the Shapiro-Wilk test. Descriptive statistical methods, including mean, median, standard deviation, percentage (25–75% Interquartile Range - IQR), and frequency, were used to evaluate study data. For comparisons of quantitative data, Student's t-test was applied for normally distributed parameters, whereas the Mann-Whitney U test was used for non-normally distributed parameters. For comparisons of qualitative data, the chi-square test (Pearson chi-square test, Fisher's exact chi-square test) was applied. A p-value of <0.05 was considered statistically significant. Our study was planned retrospectively, and all patients meeting the inclusion and exclusion criteria were included in the study.

RESULTS

A total of 26 patients were included in the study. The mean age of the cases was 15.8±3.6 years.

Among our patients, 20 (76.9%) were in the pediatric age group, and 6 (23.1%) were in the adult age group. Of the cases, 93.1% (27) had unilateral acute scrotum findings, while 2 patients (6.9%) presented with bilateral involvement. The seasonal distribution of cases was as follows: spring, 9 cases (31%); winter and summer, 7 cases each (24.1%); and autumn, 6 cases (20.7%).

Hemogram parameters such as Hb (14.9±1.3) and PLT (280.6±60.4) were reported as mean±SD.

WBC (10.2 [8.2–12.4]) and CRP (0.2 [0.2–0.6]) exhibited non-parametric distributions and were presented as median and IQR values. The mean (±SD) values for parametrically distributed data and the median (min–max) values for non-parametrically distributed data are presented in Table 1.

Table 2. Relationship between pediatric (n_p=20) and adult groups (n_a=6) in terms of hematological and biochemical markers

Parameters	Recurrence	p
Age (year)	Pediatric Adult	0.0001*
PLT (10^3/uL)	Pediatric Adult	0.016*
Hb (g/dL)	Pediatric Adult	0.027*
WBC (10^3/uL)	Pediatric Adult	0.394**
CRP (mg/dl)	Pediatric Adult	0.546**

WBC: White blood cell; CRP: C-reaktif protein; Hb: Hemoglobin; PLT: Platelet; *: Independent sample t test; **: Mann-Whitney U Test.

Table 3. The correlation analysis between age and WBC, CRP, Hb and PLT values

Parameters		Correlations	p
WBC	age (n=26)	0.183	0.342
CRP		-0.194	0.313
Hb		0.698**	0.0001
PLT		-0.418*	0.024

WBC: White blood cell; CRP: C-reaktif protein; Hb: Hemoglobin; PLT: Platelet; **: Correlation is significant at the 0.01 level (2-tailed); *: Correlation is significant at the 0.05 level (2-tailed).

Comparing treatment status between pediatric and adult patients, the chi-square test indicated no significant association (p=0.21). When classifying patients into pediatric and adult groups, Student's t-test results for age, Hb and PLT values were as follows: (p=0.0001, 0.016, 0.027), respectively. For WBC and CRP, which exhibited non-parametric distributions, p-values were (p=0.394, 0.546), respectively.

The comparative analysis of hematological and biochemical markers in pediatric and adult populations is presented in Table 2.

The correlation analysis between age and WBC, CRP, Hb and PLT values is presented in Table 3.

Table 4. Sensitivity and specificity values of Hb and PLT in pediatric and adult age groups

	AUC	p	Cut-off	Sensitivity	Specificity	Youden Index
Hb (g/dL)	0.754	0.039	14.8	0.45	0.33	0.55
PLT (10^3/uL)	0.183	0.021	270000	0.35	0.33	-0.317

Hb: Hemoglobin; PLT: Platelet; AUC: Area under curve.

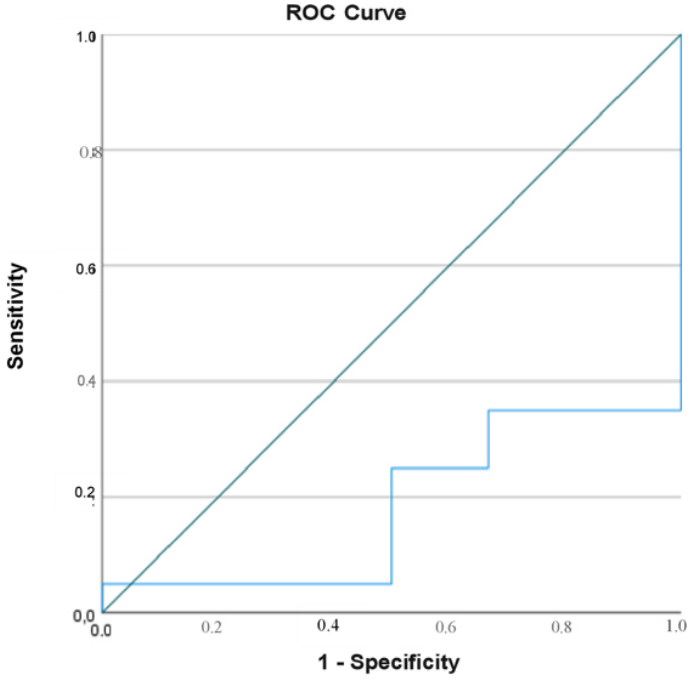

Figure 1. ROC curve graph of platelet values in pediatric and adult age groups.

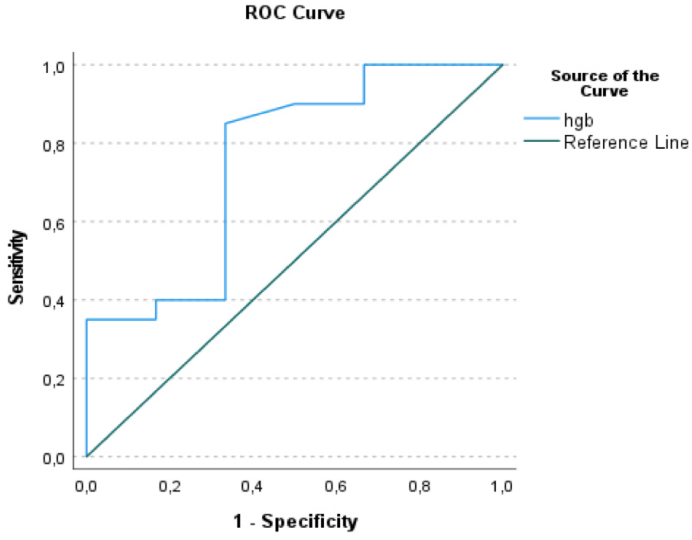

Figure 2. ROC curve graph of Hb values in pediatric and adult age groups.

The diagnostic performance of Hb (AUC 0.754, p=0.039, cut-off 14.8, Youden index 0.55, sensitivity 45%, specificity 33%) and PLT (AUC 0.183, p=0.021, cut-off 270.000, Youden index-0.317, sensitivity 35%, specificity 33%) was evaluated for pediatric and adult patient groups, with ROC curves shown in Table 4 and Figures 1, 2.

DISCUSSION

This study demonstrated significant differences between pediatric and adult patient groups in acute scrotum cases. The higher requirement for surgical intervention in pediatric patients may be associated with the increased incidence of TT in this age group. The literature suggests that TT is the most common acute scrotal condition in pediatric patients and that early diagnosis and surgical intervention are critically important [9, 10]. If TT is not treated in a timely manner, testicular loss becomes inevitable.

The seasonal analysis highlighted a higher incidence of cases in the spring. This finding suggests a potential influence of seasonal factors on the prevalence of infections. Studies indicate increased rates of viral and bacterial infections in the spring and autumn, which may be related to the incidence of AS [11, 12]. Considering the study limitations, evaluating hematological parameters specifically within AS subgroups (e.g., epididymitis, orchitis, TT) rather than collectively may contribute more effectively to the literature. We believe that conducting studies with larger patient groups will yield more objective results in understanding the connection between environmental factors and the immune response.

From a laboratory perspective, the significant age-related differences in Hb and PLT values provide important insights into the pathophysiology of acute scrotum. The finding that Hb levels are higher in pediatric patients compared to adults reflects the changing dynamics of the

hematological system with advancing age [13]. Similarly, the negative correlation of PLT levels with age is consistent with age-related changes in platelet metabolism [14]. Since our study population included patients of all age groups diagnosed with acute scrotum, this may explain the statistical differences observed in blood parameters.

Several studies have reported no significant differences in blood parameters between infectious and non-infectious acute scrotum cases. While infectious blood parameters may be elevated in cases of infectious AS, such as epididymitis, no significant differences in infectious markers have been observed in conditions like TT [15–18].

The non-parametric distribution of inflammatory parameters, such as WBC and CRP, suggests that acute scrotum encompasses multiple conditions of both infectious and non-infectious origin.

In the ROC analysis, the diagnostic performance of Hb (AUC: 0.754) was found to be higher than that of PLT (AUC: 0.183), indicating that Hb may be considered a diagnostic biomarker. However, the low sensitivity and specificity values of Hb and PLT highlight the need for these parameters to be supported by additional tests in clinical practice.

Conclusion

This study demonstrates significant age-related differences in the diagnosis and treatment of AS. The higher requirement for surgical intervention in pediatric patients underscores the importance of early diagnosis and timely intervention. However, further studies with larger sample sizes are necessary to validate these findings and to better understand the etiological differences in AS. Additionally, as a study limitation, we believe that analyzing blood parameters within specific subgroups (e.g., epididymitis, orchitis, TT) rather than under the general category of acute scrotum could contribute more effectively to the literature. Our study revealed that laboratory data may differ according to age groups, suggesting that blood parameters may be helpful in the differential diagnosis of acute scrotum.

Ethics Committee Approval: The Malatya Turgut Ozal University Clinical Research Ethics Committee granted approval for this study (date: 13.03.2025, number: E-30785963-020-291039).

Informed Consent: Written informed consents were obtained from patients who participated in this study.

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