

# Pain Severity as a Marker of Semen Abnormalities in Adolescents with Varicocele

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## What is already known on this topic?

- Varicocele is common in adolescents and may negatively affect future fertility; however, the relationship between pain severity and semen quality remains unclear.
- In most studies, pain in adolescent varicocele has been regarded primarily as a subjective symptom, and only a limited number of investigations have directly evaluated its association with semen parameters.
- Although higher pain levels are more frequently observed in high-grade varicocele, the objective assessment of pain severity and its link with semen quality is still debated in clinical practice.

## What this study adds on this topic?

- This study provides quantitative evidence demonstrating a direct association between pain severity and impaired semen quality in adolescents with varicocele.
- Increasing pain intensity was significantly related to reductions in total sperm count, sperm concentration, morphology, and motility, highlighting the clinical relevance of pain.
- These findings suggest that pain should not be viewed solely as a subjective complaint; instead, it may serve as an additional clinical marker of fertility risk when evaluating adolescents with varicocele.

## Abstract

**Objective:** Varicocele is one of the most common causes of potentially correctable male infertility, and its clinical significance during adolescence remains debated. While pain is frequently reported in adolescents with varicocele, the association between pain severity and semen quality is not well established. This study aimed to investigate the relationship between pain intensity, semen parameters, and varicocele grade in adolescent patients.

**Methods:** The data of 59 adolescent males (aged 12-19 years) diagnosed with varicocele at a tertiary care center were retrospectively reviewed. Scrotal pain severity was assessed using the Visual Analog Scale (VAS). Testicular volume was measured by ultrasonography, and semen analysis was performed according to the 2010 World Health Organization criteria. Correlations between VAS score, semen parameters, and varicocele grade were evaluated using Spearman's correlation analysis.

**Results:** The mean VAS score was  $4.9 \pm 2.1$ . Higher pain scores showed significant inverse correlations with total sperm count ( $\rho = -0.48, P < .001$ ), sperm concentration ( $\rho = -0.44, P = .001$ ), Kruger morphology ( $\rho = -0.34, P = .009$ ), and total motility ( $\rho = -0.26, P = .043$ ), while ejaculate volume showed no correlation ( $\rho = 0.02, P = .86$ ). Tanner staging was available for 39 patients, most of whom were in stages 4-5. Age did not correlate with semen parameters. Hormonal data were largely unavailable due to the retrospective design. Pain severity showed a positive but non-significant correlation with varicocele grade ( $\rho = 0.33, P = .071$ ).

**Conclusion:** In adolescents with varicocele, increased pain severity is significantly associated with impaired semen quality, particularly in sperm count and concentration. Although varicocele grade tended to correlate with higher pain scores, statistical significance was not reached. Pain should not be considered solely a subjective symptom but may serve as an additional marker of fertility risk in this population.

**Keywords:** Adolescent, infertility, scrotal pain, semen parameters, varicocele

## Introduction

Varicocele is a common venous pathology in adolescent males and may lead to adverse effects on fertility in later life. Its prevalence is approximately 15% in the general population, while this rate rises to 35%-40% among infertile men.<sup>1,2</sup> In cases of varicocele detected during adolescence, reductions in testicular volume, deterioration in semen parameters, and an increased risk of subfertility in adulthood have been reported.<sup>3,4</sup> Therefore, accurate clinical evaluation of adolescent varicocele and appropriate determination of surgical indications are of great importance.

Classically, surgical indications are based on testicular volume asymmetry, impairment in semen parameters, and the presence of symptomatic pain.<sup>5</sup> However, the objective evaluation of pain severity and its relationship with semen quality in adolescents remains a controversial issue. In the literature, pain has mostly been considered a subjective symptom, and studies directly investigating its association with semen parameters are quite limited.<sup>6,7</sup>

Scrotal pain is a frequently reported complaint, particularly in adolescents with high-grade varicocele.<sup>8</sup> Increased venous pressure, testicular hypoxia, and oxidative stress are suggested to play roles in its pathophysiology.<sup>9</sup> Nevertheless, the evidence demonstrating the relationship between pain severity and semen quality is not definitive, and this issue represents an important gap in clinical practice.

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In this study, the aim was to investigate the association between pain severity, semen parameters, and varicocele grade in adolescent patients. It is believed that this approach will better highlight the clinical significance of symptoms and may contribute to the individualization of surgical indications.

**Methods**

This retrospective study was conducted on the data of adolescent patients diagnosed with varicocele who were admitted to the Department of Urology at Gülhane Training and Research Hospital. Ethical approval was obtained from the University of Health Sciences Institutional Scientific Research Ethics Committee (Approval No.: 2025-20; Date: October 15, 2025). As this was a retrospective chart review based on existing clinical records, the requirement for individual informed consent was waived by the Ethics Committee. The research was conducted in accordance with the principles of the Declaration of Helsinki.

Adolescent male patients aged 12-19 years with a diagnosis of varicocele confirmed clinically or by ultrasonography were included. Patients with a history of prior scrotal surgery, cryptorchidism, testicular tumor, systemic disease, or those without semen analysis were excluded. Varicocele grading was performed according to the Dubin and Amelar classification based on physical examination findings. Laterality of the varicocele was recorded. Scrotal pain severity was assessed at presentation using a Visual Analog Scale (VAS, 0-10). The VAS has been validated for pain assessment in adolescents, and all patients in the present study were shown a 10-cm horizontal line anchored at 0 (“no pain”) and 10 (“worst imaginable pain”) and asked to indicate their current pain level. This method is widely accepted for children older than 8 years and is considered reliable in adolescent pain reporting.<sup>10</sup> The volume of both testes was measured by ultrasonography and recorded in cm<sup>3</sup>; when necessary, the percentage difference between testicular volumes was calculated. Pain assessment and semen analysis were performed during the same outpatient visit. The VAS score recorded at presentation corresponded directly to the semen sample obtained on the same day, ensuring the absence of any temporal discrepancy between pain evaluation and semen analysis. Each patient’s semen sample corresponded to the VAS score obtained during the same outpatient visit, ensuring that pain severity and semen parameters were assessed concurrently.

All ultrasonographic evaluations were performed by a single experienced radiologist specialized in genitourinary imaging, using the same high-resolution ultrasound system throughout the study period. Testicular volumes were calculated using the Lambert formula, ensuring consistency across measurements.<sup>11</sup> Semen samples were collected in accordance with standard adolescent varicocele research protocols. Patients were instructed to maintain 3-5 days of sexual abstinence and provided masturbation-derived samples in a private room located adjacent to the laboratory. All samples were analyzed within 60 minutes according to the 2010 World Health Organization (WHO) criteria by the same trained laboratory technician to minimize interobserver variability.<sup>12</sup>

Statistical analyses were performed using SPSS version 31.0.1.0 (IBM SPSS Corp.; Armonk, NY, USA). Descriptive statistics were expressed as mean ± SD for normally distributed variables and as median (interquartile range [IQR]) for non-normally distributed variables. The relationships between VAS score, semen parameters, and varicocele grade were tested using Spearman’s correlation analysis. Non-parametric tests (Mann–Whitney *U*-test, Kruskal–Wallis) were applied for comparisons of pain scores across varicocele grades. A *P*-value < .05 was considered statistically significant. The distribution of all continuous variables was

evaluated using the Shapiro–Wilk test. Normally distributed variables were expressed as mean ± SD, whereas non-normally distributed variables were reported as median (IQR).

**Results**

A total of 59 adolescent patients with varicocele were included in the study. The physical examination findings and semen parameters of the patients are presented in Table 1. Pain scores showed a normal distribution, while semen parameters demonstrated non-normal distributions. Accordingly, pain was expressed as mean ± SD, and semen variables were presented as median (IQR). The mean VAS score for scrotal pain was 4.9 ± 2.1 (range: 1-9). Correlation analysis revealed a significant negative association between pain severity and certain semen parameters. Specifically, higher VAS scores demonstrated significant inverse correlations with total sperm count ( $\rho = -0.48, P < .001$ ) and concentration ( $\rho = -0.44, P = .001$ ). In addition, Kruger morphology ( $\rho = -0.34, P = .009$ ) and total motility ( $\rho = -0.26, P = .043$ ) showed weaker but significant negative correlations. No significant association was observed between ejaculate volume and pain severity ( $\rho = 0.02, P = .86$ ) (Table 2).

Tanner staging was available for 39 patients. Among them, 6.8% were in Tanner stage 2, 13.5% in stage 3, 35.6% in stage 4, and 44.1% in stage 5, consistent with the expected pubertal distribution in adolescents aged 12-19 years. Notably, nearly all patients who were able to provide semen samples were in Tanner stages 4-5.

**Table 1.** Demographic, Clinical, and Semen Characteristics of Adolescents with Varicocele (n = 59)

Variable	Value
Tanner stage (2 / 3 / 4 / 5), n (%)	6.8 / 13.5 / 35.6 / 44.1
Varicocele grade (2 / 3), n (%)	64/35
Median testicular volume (cm <sup>3</sup> )	15.2 ± 1.3
Laterality (left/bilateral), n (%)	86/13
VAS pain score	4.9 ± 2.1
Ejaculate volume (mL)	3.01 ± 1.21
Sperm concentration (×10 <sup>6</sup> /mL)	42.68 ± 32.70
Total sperm count (×10 <sup>6</sup> )	108.16 ± 98.65
Total motility (%)	50.67 ± 17.28
Kruger morphology (%)	4.14 ± 2.13

VAS, Visual Analog Scale.

**Table 2.** Spearman Correlation Between Visual Analog Scale Score and Semen Parameters

Semen Parameters	$\rho$ (Spearman)	<i>P</i>
Kruger strict morphology (%)	-0.34	.009
Ejaculate volume (mL)	0.02	.860
Total sperm count (×10 <sup>6</sup> )	-0.48	<.001
Sperm concentration (×10 <sup>6</sup> /mL)	-0.44	.001
Total motility (%)	-0.26	.043

Age was not significantly correlated with semen parameters (all  $P > .05$ ), indicating no measurable confounding effect. Tanner stage data were available for a limited subset, and all patients who were able to provide semen samples were in Tanner stages 4-5, consistent with expected pubertal maturation.

Endocrine parameters (Follicle-stimulating hormone, luteinizing hormone, and testosterone) were not systematically available in the retrospective dataset. This is in line with current pediatric urology practice, in which hormonal evaluation is not routinely indicated for adolescents with clinically typical varicocele and normal pubertal progression. Consequently, hormonal values were not included in correlation analyses.

An increasing trend in VAS scores was observed with higher varicocele grades. The mean VAS score was  $4.5 \pm 2.0$  (min-max: 1-8) in patients with grade 2 varicocele and  $6.0 \pm 2.3$  (min-max: 2-9) in those with grade 3 varicocele. Spearman's correlation analysis demonstrated a positive but not statistically significant association between varicocele grade and pain severity ( $\rho = 0.33$ ,  $P = .071$ ).

These findings suggest that increased scrotal pain in adolescents with varicocele may be associated with impaired semen quality and that pain severity tends to increase in patients with higher varicocele grades.

## Discussion

In this study, the relationship between pain severity, semen parameters, and varicocele grade in adolescent patients with varicocele was investigated. These findings demonstrated that increased pain severity was associated with impaired semen quality. Specifically, higher VAS scores were significantly correlated with lower total sperm count, concentration, morphology, and motility values. In addition, pain scores were observed to increase with higher varicocele grades; however, this association did not reach statistical significance.

The clinical significance of pain in adolescent varicocele has long been debated in the literature. Varicocele is present in 35%-40% of infertile men, and pain during adolescence is among the most common presenting complaints.<sup>13</sup> However, pain has mostly been regarded as a subjective symptom, and its direct association with semen quality has been investigated in only a limited number of studies. In a systematic review by Chu et al,<sup>7</sup> it was reported that the presence of pain alone does not constitute a surgical indication, but that it gains importance when evaluated in conjunction with semen parameters. The correlation of pain severity with semen parameters in the present study supports this view.

Recent studies have also presented similar findings. Pajovic et al<sup>14</sup> reported that painful varicocele in adolescents is associated with higher grades and that these patients exhibit more pronounced deterioration in semen quality. Furthermore, Zampieri et al<sup>15</sup> emphasized that the coexistence of pain and testicular volume loss is clinically meaningful in terms of fertility prognosis. In the present series, pain scores tended to increase with higher varicocele grades, but statistical significance could not be reached due to the limited sample size.

Experimental studies on the pathophysiology of pain suggest that increased venous pressure, testicular hypoxia, oxidative stress, and local inflammatory responses play a role.<sup>16,17</sup> These mechanisms may explain both the occurrence of pain and the deterioration in semen quality. The findings of the present study are also consistent with these biological hypotheses.

The predominance of Tanner stages 4-5 among patients who were able to provide semen samples reflects a natural pubertal distribution but also introduces an unavoidable selection bias, as

younger adolescents in earlier Tanner stages are less likely to produce semen suitable for analysis.

This study has several limitations. Its retrospective design limited the availability of hormonal profiles and complete Tanner staging data. Although Tanner staging was documented in a subset of patients, nearly all individuals able to provide semen samples were in Tanner stages 4-5, introducing an inherent selection bias because younger adolescents are physiologically less likely to produce analyzable semen. Hormonal parameters (FSH, LH, and testosterone) were not routinely obtained, which prevented assessment of endocrine function. Semen parameters in adolescents may not yet reflect fully mature adult values, and WHO guidelines recommend at least 2 semen samples for fertility assessment. However, in adolescent varicocele practice, repeated semen analyses are often difficult to obtain. Therefore, a single semen sample was analyzed, as reported in several previous studies. Semen findings were interpreted in a comparative context rather than based on adult normative thresholds.<sup>18</sup> In addition, the single-center design and relatively small sample size may restrict the generalizability of the findings. Despite these limitations, the study offers meaningful quantitative evidence linking pain severity to impaired semen quality in adolescents with varicocele.

This study demonstrated that increased pain intensity in adolescents with varicocele is significantly associated with impaired semen quality, particularly in terms of sperm count, concentration, morphology, and motility. Although a positive trend was observed between varicocele grade and pain severity, the association did not reach statistical significance, likely due to the limited sample size. These findings suggest that pain should not be regarded solely as a subjective symptom but also as a potential indicator of impaired fertility potential in this population. Careful evaluation of adolescents presenting with painful varicocele is warranted, and pain intensity may be considered as an additional factor when determining surgical indications.

**Data Availability Statement:** The data that support the findings of this study are available on request from the corresponding author.

**Ethics Committee Approval:** Ethical committee approval was received from the Ethics Committee of University of Health Sciences, Gülhane Training and Research Hospital (Approval No.: 2025-20; Date: October 15, 2025).

**Informed Consent:** Written informed consent was obtained from all participants and their legal guardians in this study.

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