

Research Article

Prevalence of Abnormal Semen Parameters in Patients Presenting With Varicocele

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ABSTRACT

Background: Varicocele is a common male reproductive disorder and an important potentially reversible cause of impaired semen quality. It may adversely affect spermatogenesis through alterations in the testicular microenvironment.

Objective: To determine the frequency of abnormal semen parameters in patients presenting with varicocele.

Methods: This descriptive cross-sectional study was conducted in the Department of Urology at Liaquat National Postgraduate Medical Centre over six months following ethical approval. A total of 150 male patients aged 18-80 years with clinically diagnosed varicocele were recruited through consecutive non-probability sampling. Patients with previous varicocelectomy, abnormal follicle-stimulating hormone levels, or significant testicular volume abnormalities were excluded. Demographic and clinical characteristics, including varicocele side and grade, were recorded. Semen analysis was performed to assess sperm concentration, motility, morphology, and presence of azoospermia.

Results: Among 150 patients, oligozoospermia was the most frequent semen abnormality, followed by asthenozoospermia. Teratozoospermia and azoospermia were also observed. The findings indicate that abnormalities in conventional semen parameters are common among men presenting with clinically diagnosed varicocele.

Conclusion: Abnormal semen parameters are frequently encountered in patients with varicocele. Routine semen analysis should therefore form an important component of reproductive evaluation in these patients, particularly when infertility is suspected. Early identification of semen abnormalities may support appropriate counselling and individualized management.

Keywords: Varicocele, Semen Analysis, Oligozoospermia, Asthenozoospermia, Teratozoospermia, Azoospermia, Male Infertility.

INTRODUCTION

Male infertility is a significant reproductive health-related issue, and in 2021 it was estimated that there were 55 million men living with male infertility globally, which represents about 1.8% of all men of reproductive age. The burden is particularly important in South and East Asian populations, where prevalence of infertility is high {1}. Varicocele is an abnormal enlargement of the pampiniform venous plexus and is now known to be the most common treatable cause of male infertility and may have a negative impact on sperm production and semen quality {2}. The prevalence of varicocele in healthy men is up to 20% in large-scale electronic health records (EHR) and around 40% in men referred for primary infertility {2}. Recent evidence indicates that a correlation

exists between varicocele and poor semen quality. The mean differences in sperm concentration, motility, viability and normal sperm morphology between men with and without varicocele were -34.72 million/mL, -20.62%, -14.75% and -10.15%, respectively, in a systematic review and meta-analysis of 32 studies {3}. Likewise, a recent meta-analysis showed that sperm DNA fragmentation was significantly higher in men with varicocele, suggesting that oxidative and cellular damage may play a role in the impaired reproductive function of men with varicocele {4}. Treatment studies also suggest that there are gains in some conventional semen parameters after varicocele surgery. A large systematic review of 2420 infertile men with

clinical varicocele, showed that varicocele repair compared to untreated cases had positive results on sperm concentration, the number of sperm, progressive motility, total motility, and normal morphology {5}. Although the detrimental impact of varicocele on semen quality has been established, current data on the prevalence of each abnormal semen parameter in patients with varicocele is still scanty, especially in the local clinical setting. The present study, therefore, aimed to identify the incidence of oligozoospermia, asthenozoospermia, teratozoospermia and azoospermia in varicocele patients. The results could offer some locally relevant evidence to assess and manage affected patients clinically.

METHODOLOGY

After obtaining approval for the research synopsis, a descriptive cross sectional study was carried out in Department of Urology, Liaquat National Postgraduate Medical Centre, Karachi for a period of six months, from February 2025 to August 2025. Subjects included male patients aged 18-80 suffered from clinically diagnosed varicocele and were subjected to semen analysis. If the prevalence of azoospermia in men with varicocele is 12.9%, with a 95% confidence interval and a 2.5% margin of error, then, the sample size for this study is 150 participants. The participants were selected using a consecutive nonprobability sampling technique, until the required sample size was obtained. Male patients aged 18-80 years, who were clinically diagnosed as varicocele based on the predetermined operational criteria, performed the semen analysis and gave informed consent. The patients were excluded if they had undergone varicocelectomy before, their serum follicle-stimulating hormone (FSH) level was outside the reference range of 1-14 IU/L, and their testicular volume was small. Small testicular volume was ultrasonographically defined as a volume less than 13.9–18.9 mL and a difference of more than 20% between the left and right testicles. Once the synopsis was approved by the ethical review committee of the hospital and the College of Physicians and Surgeons Pakistan, the eligible participants were enrolled after taking informed consent. The purpose and procedures of the study were explained to each participant. Pre-designed proforma was used to record demographic and clinical information such as age, height, weight, body mass index (BMI), educational level, occupation, residential status, side of

varicocele, grade of varicocele. The presence of varicocele was clinically evaluated and was classified as present if the venous plexus was visible, palpable or only detected during the Valsalva maneuver. Sonographic assessment was also performed and the criteria of varicocele were classified following the protocol as the presence of a venous diameter exceeding 3 mm and abnormal blood flow during Valsalva maneuver. Semen samples were collected from all participants and sent to the lab for semen analysis. Abnormal semen parameters (oligozoospermia, asthenozoospermia, teratozoospermia and azoospermia) were the main outcome variables. The operational definitions for the approved protocol were that oligozoospermia was defined as a sperm count of less than 15 million/mL and asthenozoospermia was defined as less than 40% motility. The presence of abnormal sperm morphology of more than 96% of the total sperm sample was considered as Teratozoospermia and absence of any spermatozoa in the semen sample was considered as Azoospermia. These other variables were included: age, height, weight, BMI, level of education, occupation, residential status, side of varicocele and grade of varicocele. Data collected were fed to SPSS version 21 and analysed. The quantitative variables such as age, height, weight, and BMI were presented as mean and standard deviation, while the categorical variables such as educational level, occupation, type of residence, side and grade of varicocele and abnormal semen parameters were presented as frequencies and percentages. Stratification was used to control for potential effect modifiers such as age, BMI, educational status, occupation, residential status, side of varicocele and grade of varicocele. After stratification, the chi-square test was used to assess the statistical significance. A p value of < 0.05 was deemed statistically significant. After the research synopsis was approved by the ethical review committee of Liaquat National Postgraduate Medical Centre and the College of Physicians and Surgeons Pakistan, the study began. All participants gave informed consent after the purpose and procedures of the study were explained. The participation was voluntary and patients who met the predetermined inclusion and exclusion criteria were recruited.

RESULT

A total of 150 patients with clinically diagnosed varicocele were included in the analysis. The

mean age of the participants was 36.8 ± 8.7 years, while the mean height, weight, and body mass index were 1.70 ± 0.08 m, 72.4 ± 10.6 kg, and 25.0 ± 3.4 kg/m², respectively. Most participants were from urban areas (102, 68.0%). Educational status was distributed as follows: 18 (12.0%) participants were illiterate, 29 (19.3%) had primary education, 39 (26.0%) had secondary education, 31 (20.7%) had intermediate education, and 33 (22.0%) had graduate-level education or above (Table 1). The varicocele was left-sided in 91 (60.7%) participants, right-sided in 13 (8.7%), and bilateral in 46 (30.7%). Grade I varicocele was recorded in 38 (25.3%) participants, Grade II

in 62 (41.3%), and Grade III in 50 (33.3%) (Table 1).

On semen analysis, oligozoospermia was identified in 82 (54.7%) participants, asthenozoospermia in 73 (48.7%), teratozoospermia in 39 (26.0%), and azoospermia in 19 (12.7%). The distribution of the four abnormal semen parameters is shown in Table 2 and Figure 1.

After stratification according to the prespecified demographic and clinical variables, the frequency of abnormal semen parameters was compared across strata using the chi-square test. The resulting associations are presented in Figure 2.

Table 1. Demographic and Clinical Characteristics of Participants (N=150)

Variable	Value
Age, years	36.8 ± 8.7
Height, m	1.70 ± 0.08
Weight, kg	72.4 ± 10.6
BMI, kg/m ²	25.0 ± 3.4
Urban residence	102 (68.0%)
Rural residence	48 (32.0%)
Illiterate	18 (12.0%)
Primary	29 (19.3%)
Secondary	39 (26.0%)
Intermediate	31 (20.7%)
Graduate and above	33 (22.0%)
Left	91 (60.7%)
Right	13 (8.7%)
Bilateral	46 (30.7%)
Grade 0	0 (0.0%)
Grade I	38 (25.3%)
Grade II	62 (41.3%)
Grade III	50 (33.3%)

Table 2. Frequency of Abnormal Semen Parameters (N=150)

Abnormal semen parameter	n	%
Oligozoospermia	82	54.7
Asthenozoospermia	73	48.7
Teratozoospermia	39	26.0
Azoospermia	19	12.7

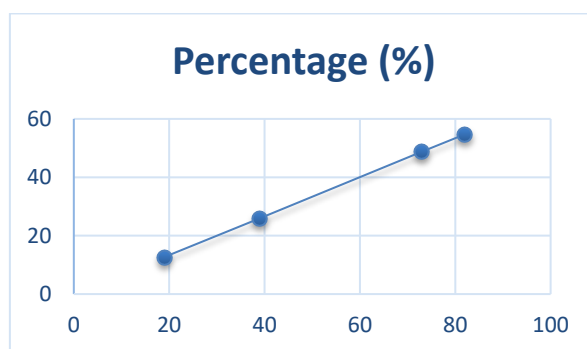


Figure 1. Frequency of Individual Abnormal Semen Parameters among Patients Presenting With Varicocele.

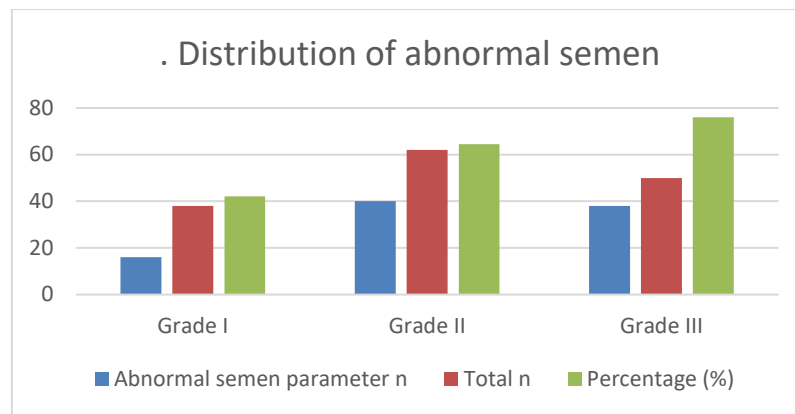


Figure 2. Distribution of Abnormal Semen Parameters According To Selected Demographic and Clinical Variables.

DISCUSSION

The present study showed that men who were referred for varicocele surgery had a significant number of abnormal semen parameters, with oligozoospermia and asthenozoospermia being most common, followed by teratozoospermia and then by azoospermia. These results are in line with the current evidence, showing that varicocele is also linked with poor performance of many of the classic semen parameters. In the recent systematic review and meta-analysis, the men with varicocele had significantly lower sperm concentration, total sperm count, sperm vitality, total motility, progressive motility and normal sperm morphology than men without varicocele {6}. Both these results and the findings of the present study indicate that semen analysis is clinically relevant in men with a diagnosis of varicocele. Chronic venous congestion, which affects the microenvironment of the testicles, may explain the predominance of impaired concentration of sperm. Varicocele can cause an increase in intra scrotal temperature, reduce the testicular oxygenation, modify venous return, and cause oxidative stress, which disrupts the normal process of spermatogenesis {7,8}. If production of ROS is too high, it may lead to detrimental changes in sperm membranes, mitochondrial function, DNA integrity and sperm maturation. The various abnormalities of semen seen in patients with varicocele can be explained by the aforementioned biological mechanisms, which have recently been found to be significantly higher in men with varicocele in comparison with their counterparts without varicocele {9}. The incidence of asthenozoospermia in the present study also matches previous studies reporting that men with varicocele have poorer sperm motility [6]. The damage of the sperm membranes and mitochondria may interfere

with energy production and cause flagellar dysfunction, which may lead to reduced sperm motility. Secondly, disruptions in the microenvironment can affect the maturation and/or functional competence of sperm cells {7,8}. Teratozoospermia could also be a sign of disruption of normal spermatogenesis and increase in oxidative damage during spermatogenesis. Therefore, it seems that varicocele-related male infertility is not a single defect but a series of defects in the production and maturation of sperm. The spectrum of semen abnormalities by severity of varicocele is important clinically because more severe venous dilation could be associated with greater disturbances of the testicular environment. However, this correlation between varicocele grade and semen quality is not consistent in all patients. There are other factors related to infertility that may affect the extent of reproductive damage, such as individual susceptibility, length of duration, age, testicular function, environmental exposures and more. Recent literature has focused on the fact that the occurrence of a varicocele is not proof of infertility and that clinical findings and semen characteristics should be used in addition to the anatomical grade when making a treatment decision {10}. The results could have implications for the clinical assessment of infertile males. Semen analysis is an important part of the assessment as there may be sperm abnormalities in all three parameters: sperm concentration, motility, and morphology. Recent literature shows that varicocele repair can positively affect several of the standard semen parameters in a proper patient population of infertile men. A systematic review and meta-analysis of 2420 infertile men with clinical varicocele showed that varicocele repair resulted in better sperm concentration, total sperm count, progressive motility, total motility,

and normal morphology than the nonrepair group {11}. A larger before and after meta-analysis was then published and showed that almost all traditional semen parameters improved after varicocele repair {12}. These results support the clinical significance of detection of semen abnormalities in men with clinically significant varicocele. The possible benefit of varicocele surgery may not just be on the conventional semen parameters. Recently, sperm DNA fragmentation has been shown to be significantly higher in men who have a varicocele compared to men who do not have a varicocele, suggesting that molecular damage to the sperm may result even if there are relatively limited conventional abnormalities of the semen {9}. Another study looking at treatment has also found decreases in oxidative-stress markers and DNA fragmentation of sperm after the varicocele surgery {13}. The above observations indicate that for some patients, sperm quality evaluation should consider both standard and functional sperm markers will eventually be necessary. The clinical significance of semen abnormalities associated with varicocele is also substantiated by the evidence associated with assisted reproductive outcomes. Recently, a systematic review and meta-analysis were conducted to assess the impact of varicocele repair prior to assisted reproductive technology (ART) and concluded that pre-treatment with varicocele repair may have a potential impact on eventual reproductive outcomes in selected infertile men {14}. However, the evidence is still somewhat inconsistent and treatment should be tailored to individual cases, taking into account clinical presentation, semen abnormalities, fertility objectives, and assessment of both partners. There were a number of strengths in the present study. It employed a predetermined sample size, consecutive recruitment, a standard clinical evaluation of the varicocele and evaluation of several semen abnormalities. Demographic and clinical parameters which may affect semen quality were also included in the study during stratification for analysis as indicated in the approved protocol {15}. These features allowed a systematic evaluation of abnormal semen parameters in the varicocele patients. There are also a few things to note. The cross sectional design did not allow the determination of a time or cause-and-effect association between varicocele and abnormal semen parameters. Findings may not be generalizable to other populations due to the use of consecutive non-probability sampling,

and the recruitment from a single tertiary care institution. In addition, the study only measured conventional semen characteristics and did not assess sperm DNA fragmentation, oxidative-stress markers, reproductive hormonal levels or pregnancy rates. The lack of longitudinal follow-up also ruled out the possibility of analyzing changes in semen parameters over time or after varicocele-directed treatment. Therefore, multicenter prospective studies using molecular sperm markers, hormonal assay, testicular volume, and pregnancy/live-birth outcome should be performed to further clarify the clinical relevance of semen abnormalities associated with varicocele.

CONCLUSION

Semen abnormalities such as poor sperm concentration and motility are common with varicoceles. It is concluded that regular semen examination should be performed in the male patients with clinically diagnosed varicocele, particularly in those assessed for infertility in this study. Abnormal semen parameters can help with timely evaluation of reproduction, appropriate counselling and individual management. While traditional semen analysis is fundamental to evaluation, in certain patients, additional evaluation may be indicated if clinically appropriate. A prospective multicenter study with the inclusion of hormonal, molecular and reproductive outcome data is warranted to further characterize the progression of the disease and to identify patients who will benefit best from targeted intervention.

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