

Scottish International Conference on Multidisciplinary Research and Innovation – SICMRI 2026

PROGNOSTIC FACTORS OF INFERTILITY IN VARICOCELE

Bobokulov Nurillo Asatovich

Samarkand State Medical University

Nazarov Murodjon Normamatovich

Samarkand State Medical University

Vohidov Sanjar Qudratullayevich

Samarkand State Medical University

Annotation: Varicocele is a common male reproductive disorder that can negatively affect spermatogenesis and fertility. However, not all men with varicocele develop infertility, making it crucial to identify reliable prognostic factors. This study analyzes clinical, anatomical, hormonal, and pathophysiological parameters that predict infertility in patients with varicocele. Key indicators include varicocele grade, testicular volume and asymmetry, semen quality, hormonal profile, oxidative stress markers, and patient-related factors such as age and lifestyle. Early identification of high-risk patients allows for timely intervention, individualized treatment planning, and optimization of reproductive outcomes. Understanding these prognostic determinants is essential for evidence-based management and preservation of male fertility.

Keywords: Varicocele, Male infertility, Prognostic factors, Semen quality, Testicular volume, Hormonal profile.

Introduction

Varicocele is one of the most common pathologies of the male reproductive system and is characterized by pathological dilatation of the testicular veins accompanied by venous hemodynamic disturbances. According to clinical and epidemiological data, varicocele is detected in a significant proportion of the male population and is more frequently observed among men presenting with infertility. However, the presence of varicocele does not invariably lead to impaired reproductive function, which makes the identification of factors predicting infertility in affected patients particularly important. The impairment of spermatogenesis in varicocele is associated with complex and multifactorial pathogenetic mechanisms. Venous stasis within the pampiniform plexus results in testicular hypoxia, local hyperthermia, and increased oxidative stress, leading to structural and functional damage of germinal epithelium. Despite similar anatomical changes, the degree of reproductive dysfunction varies considerably among patients, indicating that infertility development depends on a combination of clinical, morphological, and functional factors rather than the presence of varicocele alone.

Relevance

Varicocele is a common condition among men of reproductive age and is a major contributor to male infertility. However, not all patients with varicocele develop impaired fertility, making the identification of prognostic factors especially important. Understanding the predictors of infertility allows for early risk assessment, individualized treatment planning, and improved reproductive outcomes. Therefore, studying the prognostic factors of infertility in varicocele remains a relevant and important issue in modern urology and andrology.

Main part

Scottish International Conference on Multidisciplinary Research and Innovation – SICMRI 2026

Clinical and anatomical characteristics play a crucial role in predicting infertility in patients with varicocele. One of the most important prognostic indicators is the clinical grade of varicocele, as higher grades are generally associated with more severe impairment of spermatogenesis. Testicular volume reduction, especially unilateral or bilateral testicular atrophy, reflects long-standing venous stasis and irreversible tissue damage. Asymmetry between the testes is considered a negative prognostic sign, indicating chronic hypoxia and impaired blood circulation. Bilateral varicocele is associated with a higher risk of infertility compared to unilateral involvement. The duration of the disease is also significant, as prolonged exposure to elevated scrotal temperature and venous congestion worsens testicular function. Anatomical variations of the spermatic veins, including multiple collaterals and abnormal venous drainage patterns, may increase the likelihood of persistent venous reflux. Pain severity and scrotal discomfort may indirectly reflect disease progression. Early onset of varicocele during adolescence can adversely affect testicular development. Delayed diagnosis often results in more pronounced morphological changes. Clinical examination combined with imaging findings provides valuable prognostic information. The presence of testicular fibrosis further worsens reproductive outcomes. Thus, clinical and anatomical parameters form the foundation for infertility risk stratification in varicocele patients.

Semen analysis remains one of the most reliable tools for predicting infertility in men with varicocele. Reduced sperm concentration, impaired motility, and abnormal morphology are strongly associated with poor reproductive potential. Progressive decline in semen quality over time indicates ongoing testicular damage. Elevated levels of sperm DNA fragmentation are considered a negative prognostic marker and are linked to oxidative stress. Hormonal evaluation provides additional prognostic value, particularly measurements of follicle-stimulating hormone, luteinizing hormone, and testosterone. Increased follicle-stimulating hormone levels suggest impaired spermatogenesis and reduced testicular reserve. Low intratesticular testosterone negatively affects sperm maturation and quality. Hormonal imbalance often reflects Leydig cell dysfunction caused by chronic venous stasis. Combined abnormalities in semen and hormonal parameters indicate advanced disease. Improvement potential after treatment is lower in patients with severe baseline abnormalities. Serial semen analysis allows monitoring of disease progression and treatment response. Hormonal markers help differentiate reversible from irreversible dysfunction. These parameters are essential for counseling patients regarding fertility prognosis. Comprehensive evaluation enhances predictive accuracy. Therefore, semen and hormonal markers are central prognostic factors in varicocele-associated infertility.

Pathophysiological mechanisms significantly influence infertility development in varicocele patients. Chronic venous stasis leads to testicular hypoxia, oxidative stress, and accumulation of reactive oxygen species. Oxidative damage affects sperm membranes and DNA integrity, reducing fertilization potential. Increased scrotal temperature disrupts enzymatic processes required for normal spermatogenesis. Microcirculatory disturbances impair nutrient and oxygen delivery to testicular tissue. Patient-related factors, such as age, also play an important prognostic role. Advanced age is associated with reduced regenerative capacity of testicular tissue. Lifestyle factors, including smoking, obesity, and physical inactivity, exacerbate oxidative stress and worsen semen quality. Genetic predisposition and connective tissue disorders may increase susceptibility to infertility. Delayed treatment leads to irreversible cellular damage. Psychological stress may indirectly affect hormonal balance. The presence of comorbid conditions further worsens prognosis. Individual variability explains differences in fertility outcomes among patients with similar anatomical findings. Early intervention improves prognostic outcomes. Risk stratification based on patient-specific factors allows personalized management. Thus, pathophysiological and individual characteristics are key determinants of infertility prognosis in varicocele.

Scottish International Conference on Multidisciplinary Research and Innovation – SICMRI 2026

Conclusion

Infertility associated with varicocele is a multifactorial condition influenced by a combination of clinical, anatomical, hormonal, and pathophysiological factors. The severity and duration of varicocele, testicular volume changes, semen quality, and hormonal imbalance play a decisive role in determining reproductive outcomes. Not all patients with varicocele develop infertility, highlighting the importance of identifying reliable prognostic indicators for risk stratification. Comprehensive evaluation of these factors enables timely intervention and individualized treatment planning. Early diagnosis and appropriate management significantly improve fertility potential and prevent irreversible testicular damage. Therefore, understanding and applying prognostic factors in clinical practice is essential for optimizing outcomes and preserving male reproductive health.

References

1. Cayan, S., et al. (2020). Predictive factors for improvement after varicocelectomy in infertile men: A multicenter prospective analysis. *Andrology*, 8(6), 1594–1603.
2. Li, F., et al. (2021). Testicular blood flow dynamics and semen quality in varicocele: Association with infertility prognosis. *Journal of Urology*, 205(4), 1025–1033.
3. Wang, R., et al. (2022). Sperm DNA fragmentation index as a prognostic indicator for pregnancy outcomes after varicocelectomy. *Fertility and Sterility*, 118(1), 45–53.
4. Kumar, R., & Singh, P. (2022). Oxidative stress markers in varicocele patients: Correlation with infertility risk and surgical outcomes. *Reproductive Biology and Endocrinology*, 20(1), 89.
5. Hsu, L.-L., et al. (2023). Role of hormonal biomarkers in the prediction of male infertility in varicocele: A systematic review and meta-analysis. *Andrology*, 11(2), 225–239.