

Main Causes of Male Infertility: An Updated Review

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ABSTRACT

Male infertility is a multifactorial condition that affects about 50% of couples struggling with infertility. This study reviews the main causes of male infertility, addressing genetic, hormonal, environmental and lifestyle factors. Data collected from scientific articles published between 2015 and 2024 highlight the impact of varicocele, endocrine disorders, immunological factors and exposure to environmental toxins as the main contributors. Understanding these causes is essential for early diagnosis and effective therapeutic strategies.

Keywords: Infertility; Men; Spermatogenesis; Hormones

Introduction

Male infertility affects millions of couples worldwide and is responsible for about 40% to 50% of infertility cases in couples^{1,2}. It is defined as the inability of a man to contribute to conception after one year of regular, unprotected sexual intercourse. This condition has multifactorial causes involving genetic, hormonal, environmental and behavioral factors. Proper assessment of the factors contributing to male infertility is essential to establish effective treatment strategies. Causes of male infertility can be classified as pre-testicular, testicular and post-testicular. Pre-testicular factors include hormonal changes and systemic conditions that impair sperm production. Testicular causes range

from congenital diseases to acquired injuries and infections that directly affect the testes^{3,4}. Post-testicular factors involve problems in the transport of sperm⁵. In addition, environmental factors such as exposure to toxic substances, smoking, excessive alcohol consumption and stress are widely recognized as harmful to male reproductive health. Advances in the understanding of the biological mechanisms associated with male infertility have enabled more accurate diagnoses and individualized treatments, increasing the chances of conception⁶⁻⁹.

Objectives

This study aims to review the main causes of male infertility,

discussing their clinical implications and available therapeutic approaches based on the current scientific literature.

Materials and Methods

A bibliographic review of articles published in the PubMed, ScienceDirect and SciELO databases was conducted to support this study.

Discussion

Male infertility results from a series of complex, interrelated factors. Among the pre-testicular factors, hormonal changes involving the hypothalamic-pituitary-gonadal axis stand out. For example, hypogonadotropic hypogonadism can reduce testosterone production and compromise spermatogenesis¹⁰. Other systemic conditions, such as diabetes and autoimmune diseases, also negatively affect male fertility. Testicular causes include congenital anomalies like Klinefelter syndrome, which compromises sperm production. Varicocele, an abnormal dilation of the testicular veins, is one of the main acquired causes of male infertility, leading to increased scrotal temperature and oxidative stress that damages sperm. Infections such as viral orchitis and sexually transmitted diseases can also result in irreversible testicular damage^{11,12}.

Regarding post-testicular factors, obstructions of the vas deferens and congenital or acquired anatomical abnormalities stand out. Bilateral congenital absence of the vas deferens is often associated with cystic fibrosis. Additionally, ejaculatory dysfunctions, such as retrograde ejaculation, can prevent the proper release of sperm¹³. The impact of environmental and behavioral factors is widely recognized in the literature. Exposure to pesticides, heavy metals and industrial chemicals negatively affects semen quality¹⁴. A sedentary lifestyle, obesity and chronic stress are also associated with reduced fertility. Interventions that promote lifestyle changes have shown benefits in improving semen parameters. With advances in biotechnology, it has become possible to develop advanced assisted reproductive techniques, such as in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI), increasing treatment options for men with severe infertility^{15,16}. However, identifying and treating the underlying causes remain crucial to improving reproductive outcomes¹⁷.

Conclusion

Male infertility is a complex, multifactorial problem influenced by genetic, hormonal, environmental and behavioral causes. A detailed understanding of these causes is fundamental for accurate diagnosis and the development of effective therapeutic strategies. Detailed clinical evaluation, combined with laboratory and imaging tests, allows for the identification of the specific factors affecting male fertility. Clinical interventions range from hormonal and surgical treatments to assisted reproductive techniques, when necessary. Promoting healthy lifestyle habits and reducing exposure to harmful environmental agents are important preventive measures. Although technological advancements have expanded treatment options, ongoing research is needed to develop more effective and accessible therapies. Despite its challenges, male infertility can often be successfully treated, allowing couples to fulfill their dream of parenthood.

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