

Morphology of the Testes in the Detection of Infertility

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Resume: Infertility is understood as the absence of conception in a couple who have been living a regular sexual life without using contraception for more than one year. About 15% of couples planning to conceive face infertility every year. The cause of infertility may be reproductive dysfunction in one of the partners (male or female) or in both partners. The latter is observed most often, since the impaired fertility (the ability to have children) of one of the partners can be compensated by the preserved fertility of the other. To study the mechanisms of spermatogenesis disorders, it is necessary to create models using drugs with high gonadotoxicity or irradiation, followed by the use of methods that enhance the function and quality of spermatozoa, one of which is platelet-enriched plasma.

Key words: spermatogenesis, infertility, irradiation.

The male factor, or male infertility, is spoken of when a man has changes in the parameters of sperm or its delivery mechanism that prevent conception. This situation is observed in half of the men examined for infertility in marriage. The causes of male infertility are quite diverse and include medical factors:

1. Varicocele is a varicose vein of the scrotum that disrupts the blood supply to the testicle. The most common reversible cause of male infertility. The exact reason why varicocele causes infertility is unknown, it is probably due to an increase in scrotum temperature, leading to a violation of spermatogenesis and a decrease in sperm quality. Treatment of varicocele allows to improve sperm parameters, increase the chances of natural conception and conception as a result of the use of assisted reproductive methods (IVF/ICSI).
2. Infections of the reproductive system, which are accompanied by the ingestion of various inflammatory products into the sperm that disrupt the functioning of spermatozoa, which leads to a deterioration in sperm parameters. These include: inflammation of the epididymis (epididymitis) or the testicle itself (orchitis), the prostate gland (prostatitis) and some sexually transmitted infections, including chlamydia infection, gonorrhea, trichomoniasis.
3. Ejaculation disorders. Most often, retrograde ejaculation leads to infertility — a condition when sperm does not exit through the urethra during orgasm, but moves in the opposite direction and enters the bladder. Diabetes mellitus, spinal injuries, taking certain medications, as well as prostate or bladder surgery can lead to retrograde ejaculation. It is much less common to delay ejaculation when a man cannot achieve orgasm during sexual intercourse or reaches, but not in all sexual acts, and it takes him a significant amount of time (sometimes more than an hour).
4. Immune factors. Spermatozoa, unlike other cells in the body, contain half a set of chromosomes, so the immune system perceives them as foreign cells. Upon contact with spermatozoa, the immune system produces special proteins, antibodies, which are fixed to the spermatozoa and disrupt their functioning. Normally, this does not happen, since the testicles are arranged in a special way, and spermatozoa during maturation are protected from interaction with cells of the immune system by a special structure — the hematotesticular barrier. But any violation of the

testicular structure (trauma, varicocele, violation of the patency of the vas deferens) can lead to damage to the hematotesticular barrier and the formation of antisperm antibodies.

5. Undescended testicles (cryptorchidism). In some men, one or both testicles are not lowered into the scrotum at birth, but are located in the inguinal region or abdominal cavity. Outside the scrotum, the testicles cannot function fully, since spermatogenesis requires a temperature below body temperature. This leads to an irreversible violation of spermatogenesis, which persists even after surgical lowering of the testicles into the scrotum. The probability of infertility is significantly higher in men with bilateral cryptorchidism than with unilateral.
6. Hormonal disorders. Thyroid diseases (hyper- and hypothyroidism), adrenal gland diseases, low testosterone levels (male hypogonadism) negatively affect spermatogenesis. The most severe disorders of spermatogenesis are observed with a deficiency of the main hormone stimulating spermatogenesis — FSH (follicle-stimulating hormone), but such conditions are rare.
7. Tumors. Benign and malignant tumors of the testicle itself and structures regulating spermatogenesis, for example, the pituitary gland or hypothalamus, are often accompanied by severe disorders of sperm production. The methods used to treat tumors also have a negative effect on the quality of sperm: chemotherapy, radiation therapy, surgery.
8. Obstruction of the vas deferens. The vas deferens, along which sperm move, can be blocked at different levels: inside the testicle, in the epididymis, the vas deferens, at the level of the prostate gland or in the urethra. Causes include damage during surgery (for example, for an inguinal hernia), infections, injuries, or abnormal development as a result of hereditary diseases.
9. Chromosomal defects. Congenital diseases, such as Klinefelter syndrome, in which men are born with two X chromosomes and one Y chromosome (instead of one X and one Y), lead to improper development of male reproductive organs. Other genetic syndromes associated with infertility include cystic fibrosis, Kallman syndrome, and Kartagener syndrome.
10. Sexual problems. These may include problems with maintaining or maintaining an erection sufficient for sexual intercourse (erectile dysfunction), premature ejaculation, painful intercourse, anatomical abnormalities (location of the external opening of the urethra on the lower surface of the penis (hypospadias), or psychological problems and interpersonal problems that prevent full-fledged regular sexual life.
11. Taking medications. Testosterone replacement therapy, long-term use of anabolic steroids, cancer drugs (chemotherapy), antifungal drugs, drugs used to treat peptic ulcer disease, and some other medications can reduce sperm quality.
12. Postponed operations. Some operations may prevent sperm from entering the ejaculate. These are vasectomy (crossing of the vas deferens for the purpose of contraception), operations for inguinal hernia, operations on the scrotum or testicles, prostate surgery and large abdominal operations performed for testicular and rectal cancers.

The cause of male infertility may be environmental factors such as:

1. Industrial chemicals. Prolonged exposure to benzene, toluene, xylene, pesticides, herbicides, organic solvents, painting materials and lead negatively affects the quality and quantity of sperm.
2. Heavy metals. Exposure to lead or other heavy metals can also inhibit spermatogenesis.
3. Radiation or X-rays. Exposure to radiation can significantly reduce the number of spermatozoa in sperm. As a rule, the effect is reversible, and after a while the sperm parameters are restored to normal values. At high doses of radiation, sperm production can be irreversibly disrupted.
4. Overheating of the testicles. An increase in the temperature of the scrotum has a negative effect on spermatogenesis. Frequent use of saunas and baths can worsen the quality of sperm. Prolonged sitting, tight underwear and clothing, and working with a laptop lying on your lap can also increase the temperature of the scrotum and negatively affect sperm production.

Lifestyle, bad habits and professional conditions also affect male fertility:

1. Drug use. Cocaine and marijuana have a reversible negative effect on the quantitative and qualitative parameters of sperm.
2. Excessive alcohol consumption. Alcohol abuse can lower testosterone levels, cause erectile dysfunction and reduce sperm production. Liver diseases caused by excessive alcohol consumption also lead to fertility problems.
3. Smoking tobacco. Men who smoke have significantly worse sperm quality than non-smoking men. Secondhand smoke can also affect male fertility.
4. Emotional stress. Hormones produced during stress suppress the secretion of substances that stimulate spermatogenesis. Prolonged and severe stress can lead to significant changes in sperm parameters.
5. Overweight. Obesity introduces an imbalance in the normal male hormonal status, which leads to a decrease in male fertility.
6. Occupational hazard. Men in some professions, such as drivers or welders, have a higher risk of infertility compared to other men.[3]

In 30% of men with impaired sperm parameters, it is not possible to determine the cause, this form of male infertility is called idiopathic (causeless).

Compared to a sperm, an egg is a fairly large cell, the largest in the human body. After leaving the ovary, it is surrounded by a cloud of cells called follicular cells, through which sperm must penetrate before coming into contact with the surface of the egg. In order to pass through the follicular cells, the sperm must use an intense style of movement (hyperactivation), which they used to detach from the walls of the fallopian tube.

After passing through the follicular cells, 1-2 sperm cells reach the egg, which need to get inside. To do this, the sperm has a pouch of enzymes at the very top of the head, which bursts as soon as the sperm comes into contact with the outer surface of the egg. These enzymes help to dissolve the outer membrane of the egg and, in combination with powerful movements of the tail, help the sperm to penetrate into the egg. As soon as the sperm gets inside, the egg membrane changes its chemical properties and becomes completely impervious to other spermatozoa. After the fusion of the sperm with the egg, an embryo is formed, and the development of pregnancy begins.

If the sperm is functionally immature and does not contain the necessary signaling molecules on its surface, it will not be able to come into contact with the egg, and fertilization will not occur. There is a rare anomaly — globulozoospermia, when spermatozoa do not have a conical, but a round head. The reason for this is the absence of a pouch with enzymes (acrosomes), which also excludes the penetration of the sperm into the egg.

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