

SPERM ABNORMALITIES AND ITS TREATMENT

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ABSTRACT

The term sperm is derived from the Greek word sperma means "seed" and it refers to the male reproductive cells. In the types of sexual reproduction known as anisogamy and oogamy, there is a marked difference in the size of the gametes with the smaller one being termed the "male" or sperm cell. A uniflagellar sperm cell that is motile is referred to as a spermatozoon, whereas a non-motile sperm cell is referred to as a spermatium. Sperm cells cannot divide and have a limited life span, but after fusion with egg cells during fertilization, a new organism begins developing, starting as a totipotent zygote. Sperm morphology the size and shape of sperm is checked as part of a standard semen analysis for male infertility. Many different types of sperm abnormalities occur. A common classification scheme is based on the location of the abnormalities. Those that are located in the sperm head are classified as primary. Abnormalities associated with neck, midpiece or tail are classified as secondary abnormalities. Included in the secondary abnormalities is the presence of cytoplasmic droplets.

KEY WORDS: Sperm, PMDS, IVF, ICSI

INTRODUCTION

More than 90% of male infertility cases are due to low sperm counts, poor sperm quality, or both. In 30% to 40% of cases of sperm abnormalities, the cause is unknown. It may be the end result of one or a combination of factors that include chronic illness, malnutrition, genetic defects, structural abnormalities, and environmental factors. Partial obstruction anywhere in the long passages through which sperm pass can reduce sperm counts. In one study, obstruction was believed to be a contributing factor in over 60% of low sperm count cases. Obstruction itself can be caused by many factors.¹⁻³

Different categories of sperm abnormalities

Sperm abnormalities are categorized by whether they affect sperm count, sperm quality, or both:

Low Sperm Count

Men were most likely to be fertile with a sperm count over 48 million per milliliter of semen and least likely with counts below 13.5 million. In the past, a sperm count of less than 40 million/mL in the ejaculate was believed to cause infertility. Now, however, if the woman is fertile and young, a count as low as 10 million can often accomplish conception over time, even without treatment. In fertilization clinics, men with low sperm counts report fertilization rates of about 30%, while those with average sperm counts have rates between 60% and 80%. Sperm count varies widely over time and temporary low counts are common. Therefore, a single test that reports a low count may not be a representative result.⁴

Sperm Motility

Sperm motility is the sperm's ability to move. If movement is slow, not in a straight line, or both, the sperm have difficulty invading the cervical mucous or penetrating the hard outer shell of the egg. If 60-63% or more of sperm have normal motility, then the sperm is at least average in quality. If less than 32-40% of sperm are able to move in a straight line, the condition is considered abnormal.

MORPHOLOGY OF SPERM

There are mainly two types of morphology of sperm/spermatozoa

Morphology of Bull Spermatozoa

- Primary Abnormalities of the Head
- Secondary Abnormalities of Neck and Tail

Symptoms

- In the normal canine male, during fetal development, the testes are located in the vicinity of the kidneys and then migrate across the abdominal cavity and eventually descend into the scrotum. The rate of migration can be variable from individual to individual, however, on the average, the testes are completely descended within 10 to 14 days following birth. In only a

minority of dogs does descent occur as late as 6 months, and this variation is considered suspect of a developmental abnormality.

- Males with chromosomal sex abnormalities may appear "male", but typically exhibit underdeveloped genitalia and are sterile.
- The degree of masculinization in an XX male is dependent upon the amount of testicular tissue present in the individual. XX males may have bilateral testes, but they are often cryptorchids. Additionally, abnormalities of the anatomy of the prepuce and penis, with abnormal location of the urinary tract opening (hypospadias), are typically observed.
- Males with PMDS (Persistent Mullerian Duct Syndrome) may have normal testes development (though about half are cryptorchid) and appear masculine by all outward appearances; however, they also have a female reproductive tract including a uterus with cervix, oviducts and a portion of the vagina. PMDS is typically not detected by routine physical examination, but is diagnosed when symptoms related to pyometra (uterine infection), urinary tract infection, or prostate infection arise in the affected male.
- The urethral opening may appear anywhere between its normal location at the tip of the penis to the scrotum.
- Infections associated with orchiepididymitis present with scrotal swelling, testicular enlargement, pain, and fever.
- Dogs with testicular torsion exhibit pronounced enlargement of the testis. Pain may be so intense as to elicit a state of shock (rapid heartbeat [tachycardia], delayed capillary refill time, pale or muddy mucus membranes, weak pulse, vomiting). Torsion of a retained testis presents as abdominal pain.
- Dogs with inguinoscrotal hernias (when a portion of the intestine loops into the scrotum, separating the testis from the scrotal wall) present with sudden (acute) swelling of the scrotum. Typically, the condition is painless unless the intestinal loop becomes twisted. Twisting of the herniated intestine compromises blood flow to the tissue and will result in an emergency medical condition presenting with intense pain and symptoms of shock (rapid heartbeat [tachycardia], delayed capillary refill time, pale or muddy mucus membranes, weak pulse, vomiting).
- Males infected with Mycoplasma or Ureaplasma demonstrate fertility problems with or without evidence of testicular infection, prostatitis, or scrotal swelling. Infection leads to inflammatory processes that create an abnormal environment for production of spermatozoa. Additional effects on sperm may include alteration of sperm motility, interference of normal sperm metabolism by which the sperm recognizes the ova,

impairment of ova-penetrating ability, and inducing autoimmune damage to the sperm.⁵⁻⁶

DIAGNOSIS

The following test/procedure are done for diagnosis of sperm abnormality:

Fertility History

The patients will provide the physician with a detailed history of any medical or sexual factors that might affect fertility. The history should include the: Frequency and timing of sexual intercourse, Duration of infertility and any previous fertility events, Childhood illnesses and any problems in development, Any serious illness (diabetes, respiratory infections, cancer, previous surgeries), Sexual history, including any sexually transmitted diseases, Any exposure to toxins, such as chemicals or radiation, History of any medications and allergies, Any family history of reproductive problems.

Physical Exam

A fertility specialist, usually a urologist, will perform a physical examination. A physical examination of the scrotum, including the testes, is essential for any male fertility work-up. It is useful for detecting large varicoceles, undescended testes, absence of vas deferens, cysts, or other physical abnormalities.

- Varicoceles large enough to possibly interfere with fertility can be felt during examination of the scrotum. In such cases, they are described as feeling like "a bag of worms." They disappear or are greatly reduced when the patient lies down, so the patient should be examined for varicocele while standing.
- Checking the size of the testicles is helpful. Smaller-sized and softer testicles along with tests that show low sperm count are strongly associated with problems in sperm formation. Normal testicles accompanied by a low sperm count, however, suggest possible obstruction. The physician may also take the temperature of the scrotum with a test called scrotal thermography.
- The physician will also check the prostate gland for abnormalities.
- The penis is checked for warts, discharge from the urinary tract, and hypospadias (incorrect location of the urethra opening).⁷

Post-Ejaculatory Urine Sample

A urine sample to detect sperm after ejaculation may rule out or indicate retrograde ejaculation. It also may be used to test for infections

Semen Analysis

The basic test to evaluate a man's fertility is a semen analysis. The sperm collection test for men who can produce semen involves the following steps:

- A man should abstain from ejaculation for several days before the test because each ejaculation can reduce the number of sperm by as much as a third.
- A man collects a sample of his semen in a collection jar during masturbation either at home or at the physician's office. Proper collection procedure is important, since the highest concentration of sperm is contained in the initial portion of the ejaculate. Specially designed condoms may be available that will enable collection of a sample during sexual intercourse. (Regular condoms are not useful, since they often contain substances that kill sperm.)
- The sample should be kept at body temperature and delivered promptly, because if the sperm are not analyzed within two hours or kept reasonably warm, a large proportion may die or lose motility.
- A semen analysis should be repeated at least three times over several months.

Both the man and the woman should be present when the physician discusses the results of this analysis so that both partners will understand the implications. The analysis report should contain results of any abnormalities in sperm count, motility, and morphology as well as any problem in the semen. It should be noted, however, that semen analysis alone is not necessarily a definitive indicator of infertility or fertility.

Sperm Count

A low sperm count should not be viewed as a definitive diagnosis of infertility but rather as one indicator of a fertility problem. Although in a large 2001 analysis sperm counts below 13.5 million were considered a strong indication of infertility, pregnancy was possible so long as any motile sperm were present. If there are no sperm cells at all in the semen, the physician checks for obstruction in the tubes or for Sertoli cell-only syndrome, in which there are no sperm-producing cells in the testes. An at-home test (FertilMARQ) is now available to help gauge sperm quantity.

Sperm Motility

Motility (the speed and quality of movement) is graded on a 1 to 4 ranking system. For fertility, motility should be greater than 2.

- Grade 1 sperm wriggle sluggishly and make little forward progress. (Sperm that, in fact, clump together may indicate that antibodies to the sperm are present.)
- Grade 2 sperm move forward, but they are either very slow or do not move in a straight line.
- Grade 3 sperm move in a straight line at a reasonable speed and can home in on an egg accurately.
- Grade 4 sperm are as accurate as Grade 3 sperm, but move at terrific speed.

More than 63% of sperm should be motile for normal fertility, but even men whose motile sperm constitutes only about a third of the total sperm count should not rule out conception. Testing for sperm motility is particularly valuable for predicting the success of artificial insemination and which men might be candidates for the Intracytoplasmic sperm injection (ICSI) fertilization technique, in which the sperm is inserted directly into the egg and motility plays almost no role.⁸

Sperm Morphology

Morphology is the shape and structure of the sperm and, of the three main sperm values, may be the best predictor of fertility. Older reports indicated that about 60% of the sperm should be normal in size and shape for adequate fertility. However, a 2001 major analysis used a much broader range of criteria for sperm morphology and concluded that values over 12% were good predictors of fertility. Determining the morphology of the sperm is particularly important for the success of the fertility treatments in vitro fertilization (IVF) and Intracytoplasmic sperm injection (ICSI).

Seminal Fluid

The seminal fluid (semen) itself is analyzed for abnormalities. The color is checked and should be whitish-gray.

The amount of semen is important. Most men ejaculate 2.5 to 5 milliliters (mL) or cubic centimeters (cc) (1/2 to 1 teaspoon) of semen. Either significantly higher or lower amounts can be a sign of trouble:

The semen will be tested for how liquid it is. Normal semen is liquefied within 20 minutes after adding certain enzymes.

Blood Tests

Blood tests are used for measuring a number of factors that might affect fertility:

Hormonal Levels

Tests for certain hormone levels are indicated if semen analysis is abnormal (especially if sperm concentration is less than 10 million per milliliter) or there are other indications of hormonal disorders.

- Blood tests for testosterone and follicle-stimulating hormone (FSH) levels are usually taken first.
- If testosterone levels are low, then luteinizing hormone (LH) are measured.

Postcoital Test

The postcoital test, also known as the cervical mucus penetration test, is designed to evaluate the effect of a woman's cervical mucus on a man's sperm. Typically, a woman is asked to come into the physician's office within two to 24 hours after intercourse at mid-cycle (when ovulation should occur). A small sample of her cervical mucus is examined under a microscope. If the physician observes no surviving sperm or no sperm at all, the cervical mucus should then be cultured for the presence of infection. The test cannot evaluate sperm movement from the cervix into the fallopian tubes or the sperm's ability to fertilize an egg.

Test For Sperm Antibodies

If a man has had a vasectomy reversed and still cannot conceive or if semen analysis shows sperm clumping together, blood tests for anti-sperm antibodies will be conducted. Anti-sperm antibodies may also develop after genital infection or injury to the testes. The primary negative effect of these antibodies is to bind the sperm to the woman's cervical mucus, preventing the sperm from swimming further up.⁹

The two recognized and widely accepted testes to specifically assess for the presence of antisperm antibodies are:

The SpermMar test

The Immunobead test

Testicle Biopsy

Occasionally, a testicle biopsy may be performed, particularly for the following:

- If Sertoli cell-only syndrome is suspected, in which sperm-producing cells in the testes are absent. It should be noted that specific cellular patterns can determine whether this condition is congenital (inborn) or caused by some later injury. This distinction is important in predicting the potential success of later sperm retrieval procedures.
- For detecting obstruction in the transport system when sperm production looks normal but the count is low.

Ultrasound

Ultrasound imaging may be used to accurately determine the size of the testes or to detect cysts, tumors, abnormal blood flow, or varicoceles that are too small for physical detection (although such small veins may have little or no effect on fertility). It also can detect testicular cancer, which some experts believe make it worthwhile as a routine procedure for any male infertility work-up.

Genetic Testing

Genetic testing may be warranted in men who are severely deficient in sperm and who show no evidence of obstruction, particularly in men undergoing the ICSI procedure. In one study of men attending a fertility clinic, over a third were found to have genetic defects. If genetic abnormalities are suspected in either partner, counseling is recommended. Researchers are testing techniques such as preimplantation genetic diagnosis (PGD) that can examine all the chromosomes in a human embryo and detect defective genes, such as those for cystic fibrosis, at the very earliest stages. If it proves useful, it may help identify numerous abnormalities that increase the risk for infertility, treatment failures, or genetic defects in the offspring. In fact, a 2003 study suggested that performing an initial genetic analysis to determine DNA fragmentation in sperm may be a better way of predicting whether conception will succeed than analyzing semen.

Fertilization Tests

In men who wish to undergo fertility treatments, certain tests will help determine the right strategies.

The Hamster Test

The hamster test, or micro-penetration assay test, uses the sperm sample to fertilize hamster eggs that have had their covering removed to allow penetration. If less than 5% to 20% of the eggs are fertilized, infertility is diagnosed. It may be useful for determining the best assisted reproductive treatment options for men with infertility.

The Human Zona Penetration Test

The human zona penetration test uses sperm to fertilize dead human eggs, which are usually obtained from an ovary that was removed for medical purposes. (Like the hamster test, the procedure cannot result in a living embryo.) Results may provide the same information as the hamster test and also indicate whether the sperm can penetrate the outer coating of an egg.¹⁰

Acrosome Reaction Test

Tests that induce the ability of the sperms enzyme-rich covering (acrosome) to dissolve can be very useful.

Investigative Tests

Additional advanced laboratory tests to measure sperm function may also be performed. They assess such factors as the level of cell-damaging oxidants, and computer-aided sperm motility analysis.

TREATMENT

Unless a man produces no sperm at all, recent developments in treatment have made fertility possible for many men willing to undergo treatment.

Normally following treatment procedure are taken into consideration.

Dietary Considerations

Everyone should have a healthy diet, rich in fresh fruits and vegetables, whole grains, and replacing animal fats with monounsaturated oils (such olive oil) and fish oils. Choosing fish in any case is always a good choice. One study suggested that fish oil supplements might have some benefits on sperm. Such supplements contain fatty acids that are found in certain oily fish (e.g., salmon, tuna, mackerel, sardines).

Other Lifestyle Changes

A man who wants to increase his sperm count should also pursue a healthy lifestyle:

- Avoid cigarettes and any drugs that may affect sperm count or reduce sexual function.
- Overweight men should try to reduce their weight.
- Get sufficient rest, and exercise moderately but regularly. (Those who exercise excessively might cut back, but not stop altogether.)
- Stress may contribute to reduced sperm quality. It is not known if stress reduction techniques can improve fertility but they may help couples endure the difficult processes involved in fertility treatments.
- Although studies now indicate that tight underwear and pants pose no threat to male fertility, there is no harm in wearing looser clothing.
- To prevent overheating of the testes men should avoid hot baths, showers, and steam rooms.¹¹

Hormone therapy

Hormone therapy has been effective for women with infertility problems, but has been disappointing in men except in a few specific cases:

- Gonadotropin-releasing hormone (GnRH) is often very helpful in restoring fertility in men with gonadotropin deficiency and hypogonadism.
- GnRH may be useful for restoring sperm production after chemotherapy treatments.
- Sperm production occasionally responds to low doses of estrogen and testosterone or testosterone alone, menotropins (Pergonal, Repronal), clomiphene citrate (Clomid), human chorionic

gonadotropin (hCG), or human follicle-stimulating hormone (r-hFSH, Gonal-F).

- Prolonged treatment with follicle-stimulating hormone (FSH) prior to ICSI may improve implantation rates.
- Aromatase inhibitors block aromatase, an enzyme that is a major source of estrogen in many major body tissues. These agents include anastrozole (Arimidex) and letrozole. (Femara). They may be helpful for specific men whose infertility is associated with an abnormal testosterone-to-estrogen ratios.

Nonhormonal Agents

Bromocriptine. Bromocriptine (Parlodel) is used in men whose infertility is related to excess prolactin manufactured by the pituitary. Antibiotics. Infections interfering with fertility may be successfully treated with antibiotics. Mast Cell Blocking Antihistamines. Studies report that certain antihistamines that block mast cells may be beneficial for some men with low sperm counts. Mast cells are inflammatory immune factors that may play a role in lower sperm quality. Studies have reported that two such agents used overseas, ebastine and tranilast, improved pregnancy rates. Similar antihistamines in the US are fexofenadine (Allegra), loratidine (Claritin), and cetirizine (Zyrtec).

Treatment for Antisperm antibodies

Usually treated with intrauterine inseminations (to avoid the cervical mucus) or In Vitro Fertilization, regardless of antibody type. Since this treatment does not change according to the site on the sperm that is attached to the antibodies simply determining whether the patient has an abnormal postcoital test appears to be the most direct, simple and cost effective test for these antibodies. Antisperm antibody titers may be suppressed with steroids. These medications have potentially serious complications, appear to have an effect on antisperm antibody titers only after several months of administration, and the dosages of the medications for this indication have not been clearly established. Therefore, I have not tried to suppress the production of antibodies with steroids.¹²

Miscellaneous Surgical Procedures

Surgical Treatment of Obstructions

Obstructions in the area of the ejaculatory ducts have been successfully treated by excising or scraping the area where the prostate gland surrounds the urethra and by reconstructing the ducts.

Correcting Undescended Testicles

Undescended testicles of young boys may be repositioned surgically to prevent later infertility. It is important to perform the operation before 15 to 18 months of age to prevent the destruction of most of the sperm-producing cells, which occurs if the testicles remain in the abdomen.

CONCLUSION

The results of a sperm morphology exam indicate the percentage of sperm that appear normal when semen is viewed under a microscope. Sperm cells cannot divide and have a limited life span, but after fusion with egg cells during fertilization, a new organism begins developing, starting as a totipotent zygote.

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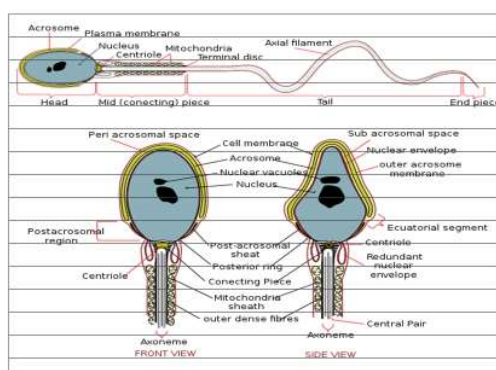


Figure.1 Sperm front and Side view

Table 1: Different categories of Sperm abnormalities

Category	Medical Name	Description / Comment
Low sperm count	Oligospermia	Generally defined as than 10 million sperm/mL of semen. There are literally dozens of causes of temporary and permanent low sperm count.
No sperm	Azoospermia	Complete absence of sperm. This is relatively rare, affecting less than 1% of all men and 10% to 15% of infertile men. This may be due to obstruction or a failure to produce sperm in the testes, which can be caused by infections such as mumps, genetic disorders, radiation, or exposure to chemicals.
Low-quality sperm	Dyospermia	Quality of sperm is determined by following: 1.Its motility(its ability to move) 2.Its morphology(its shape and structure)
No semen production	Aspermia	Ejaculation does not emit any semen