VARICOCELE

An abnormal enlargement of the pampiniform venous plexus in the scrotum.

🔍 Diagnosis ♂ Male

Related Diagnoses:
- Azoospermia
- Erectile dysfunction
- Obesity
- Non-obstructive azoospermia
- Oligozoospermia
- Hypogonadism
- Sperm autoantibodies
- Benign prostatic hyperplasia
- Teratospermia
- Globozoospermia
- Idiopathic male infertility
- Hypoandrogenism
- Testicular atrophy
- Nutcracker syndrome
- Renal cell carcinoma

ℹ️ About Varicocele

An abnormal enlargement of the pampiniform venous plexus in the scrotum. Varicocele is a common abnormality with the following andrological implications: failure of testicular growth and development, symptoms of pain and discomfort, male infertility. Varicocele is frequently diagnosed when a patient is 13–30 years of age, and rarely develop after the age of 40. Overall, it occurs in 15-20% of all males.

The idiopathic varicocele occurs when the valves within the veins along the spermatic cord do not work properly. This is essentially the same process as varicose veins, which are common in the legs. This results in backflow of blood into the pampiniform plexus and causes increased pressures, which on rare occasion can lead to permanent damage to the testicular tissue due to disruption of normal supply of oxygenated blood via the testicular artery. A majority of idiopathic varicoceles occur on the left side, because the left testicular vein travels superiorly and connects to the left renal vein (at a 90-degree angle), while the right testicular vein drains directly into the inferior vena cava. Isolated right sided varicoceles are rare. Although recent studies have shown that varicocele is a bilateral disease and the diagnosis of the right side is missed by physical examination and even by ultrasonography.
Physical examinations and scrotal ultrasounds remain the most commonly used methods to identify this problem. Upon palpation of the scrotum, a non-tender, twisted mass along the spermatic cord is felt. Palpating a varicocele can be likened to feeling a bag of worms. When one is lying down, gravity may allow the drainage of the pampiniform plexus and thus make the mass not obvious. This is especially true in primary varicocele, and absence may be a sign for clinical concern. The testicle on the side of the varicocele may or may not be smaller compared to the other side.

Varicocele can be reliably diagnosed with ultrasound, which will show dilation of the vessels of the pampiniform plexus to greater than 2 mm. The patient being studied should undergo a provocative maneuver, such as Valsalva's maneuver (attempting expiration against a closed airway) or standing up during the exam, both of which are designed to increase intra-abdominal venous pressure and increase the dilatation of the veins. An ultrasound machine that has a Doppler mode (a technique of measuring the speed at which blood is flowing in a vessel) can see blood reverse direction in a varicocele with a Valsalva, increasing the sensitivity of the examination.

**A secondary varicocele** is due to compression of the venous drainage of the testicle. A pelvic or abdominal malignancy is a definite concern when a unilateral right-sided varicocele is newly diagnosed in a patient older than 40 years of age. One non-malignant cause of a secondary varicocele is the so-called "Nutcracker syndrome", a condition in which the superior mesenteric artery compresses the left renal vein, causing increased pressures there to be transmitted retrograde into the left pampiniform plexus. The most common cause is renal cell carcinoma (a.k.a. hypernephroma) followed by retroperitoneal fibrosis or adhesions.

Although there are different theories related to the disease pathophysiology, the effects of varicocele on testicular dysfunction and infertility are not completely understood. However, many pathophysiological mechanisms related to this status have been described. These mechanisms include increased scrotal and intratesticular temperature, hypoxia, low back of adrenal and renal toxic metabolites, increased venous pressure, immunologic factors, apoptosis, and impairment of enzymatic functions. Among these mechanisms is the most extensively studied and accepted mechanism of increased testicular heat. In previous studies, the increased heat was shown to decrease the levels of heatshock proteins by affecting androgen synthesis. Another mechanism related to the association between varicoceles and male infertility is increased oxidative stress (OS). Varicoceles may increase reactive oxygen species (ROS) production and decrease antioxidant capacity. Thus, varicoceles can cause OS. A number of studies have demonstrated an increase of OS in serum, semen, and testicular tissues of patients with a clinical diagnosis of varicocele. This suggests that the impairment of sperm parameters found in men with varicocele may be related to oxidative stress. In
addition, an abnormal amount of ROS and antioxidants is connected to sperm motility defects and sperm quality. Other pathologies that could affect the spermatogenesis in patients with varicocele are Y chromosome microdeletions, acrosome reaction disorders, protamine deficiency, and endocrinological changes.

**Associated diseases**

- benign prostatic hyperplasia
- nutcracker syndrome
- renal cell carcinoma
- retroperitoneal fibrosis
- retroperitoneal adhesions

**Complications**

The most common complication of untreated varicocele is higher temperature of the testes, resulting in testicular atrophy causing infertility.

**Risk factors**

One of the main risk factor of varicocele is age. Most of patients with varicocele are men between 15 and 25 years. Other conditions, which can have connection with varicocele are kidney cancer and testicular or scrotal injury.

It was found that the incidence of varicocele is related to some anthropometric and somatometric parameters.

Tight clothing, constipation, wearing a truss may be also a risk factor. Athletes have high incidence of varicocele, spermatogenesis will be more affected in those sport-men with varicocele if they did vigorous physical activity.

Some studies discussed the protective role of higher BMI and/or weight on the development of varicocele. Others discussed the negative influence of height. Obesity and high BMI may be correlated with increased adipose tissue in the spermatic cord which may lead to decrease in the detection of varicocele by examination.

**Impact on fertility**

Varicocele can be harmless, but in some cases it can cause infertility and pain. Some studies have shown that varicocele surgery can improve low
motility of sperms and their counts but randomized and controlled trials show that there is no significant improvement in pregnancy rates. There is a difference between manage a higher sperm count, and getting the female partner pregnant. A couple still might need inseminations with male partner's sperm, or possibly in vitro fertilization anyway. It is necessary to consider the degree of abnormality in the semen and other factors involved in the individual couple's case.

Anti sperm antibodies (ASA) are present approximately in 10% of infertile males and in (24.6% and 32%) among patients with varicocele. ASA impair the fertilizing ability of spermatozoa by acting negatively on sperm motility, sperm agglutination and cytotoxic reaction which could lead to poor cervical mucus penetration and in vitro gamete interaction.

**Prevention**

Although there is no strict way to prevent varicocele, some general advices should be taken:

- avoiding hot temperatures
- avoiding heavy lifting
- improving healthy lifestyle

**Symptoms**

- visible or palpable (able to be felt) enlarged vein
- dragging-like or aching pain within scrotum
- feeling of heaviness in the testicle(s)
- atrophy (shrinking) of the testicle(s)
- alteration of testosterone levels
- benign prostatic hyperplasia (BPH) and related urinary problems

**Therapies**

**Self therapy**

Natural treatment methods typically involve improving blood circulation in the lower torso, e.g. by alleviating constipation, reducing inflammatory effects, and lowering blood viscosity. These methods could involve dietary supplementation, various exercises like swimming and cooling of the scrotum.
Traditional Chinese Medicine (TCM)

In recent years, a large number of clinical reports of Chinese herb combined with surgery in the treatment of varicocele infertility were published; however, its efficacy- and safety-related systematic evaluation was poorly stated. Many scholars have recommended that surgery can improve the chances of infertile patients with varicocele fertility in different views.

In the TCM theory, the kidney is the organ that stores kidney essence and plays a crucial role in reproduction. Because of the complex etiology, Chinese physicians have different views on the etiology and pathology of varicocele infertility. However, most Chinese physicians think that kidney emptying and blood stasis are basic causes of varicocele infertility and TCM therapy can supplement the kidney essence and promote the blood circulation to remove blood stasis and thereby cure the varicocele infertility.

Substantial pharmacological researches have been performed to investigate the chemical constituents of a variety of TCMs. Many of the TCMs have strong antioxidant activity and function like gonadotropins, which can increase the production of testosterone and improve the sperm motility. Chinese herbal medicine, Fu Pen Zi (palm-leaf raspberry fruit), can increase testosterone levels of rats but reduce the estradiol levels. Ba Ji Tian (radix morindae officinalis) has been shown to increase the production of testosterone and has protective effects against hydrogen peroxide-induced oxidative stress. Tu Si Zi (Semen Cuscutae) can markedly improve the sperm motility. Many Chinese herbal medicines possess strong antioxidant activity, which play a role in stabilizing the sperm membrane and reduce the lipid peroxidation of the sperm plasma membrane that may result in sperm dysfunction and cell death. There are some other Chinese herbal medicines for male infertility, which may increase the trace elements.

Conventional medicine

Pharmacotherapy

Medical treatment with L-carnitine has some beneficial effect on sperm parameters, but is not as effective as surgery. Micronised purified flavonoid fractions (MPFF)(Daflon) have a beneficial effect on reducing varicocele pain and reducing reflux time of left spermatic vein during the Valsalva maneuver.
Surgical therapy

The surgical treatment is varicocelectomy which involves ligation of testicular veins. Access to the veins can be gained through subinguinal, transinguinal, or suprainguinal incision. This operation can be done by open, laparoscopic, microscopic, or embolization unilaterally or bilaterally. Earlier studies on the use of varicocelectomy for the treatment of varicocele induced infertility indicated a remarkable improvement in fertility profile. In addition, clinical trials concerning treatment effectiveness show conflicting results and varicocelectomy has been criticized especially under the light of evidence-based medicine.

Varicocelectomy has also a potential to obviate the need for ART or to downstage the level of ART needed to bypass male factor infertility. Recently, it has been shown that treatment of clinical varicocele may also improve the outcomes of assisted reproduction in couples with varicocele-related infertility.

An alternative to surgery is embolization, a minimally invasive treatment for varicocele that is performed by an interventional radiologist. This involves passing a small wire through a peripheral vein and into the abdominal veins that drain the testes. Through a small flexible catheter, the doctor can obstruct the veins so that the increased pressures from the abdomen are no longer transmitted to the testicles. The testicles then drain through smaller collateral veins. The recovery period is significantly less than with surgery and the risk of complications is minimized with overall effectiveness similar to surgery, yet with fewer recurrence rates. However, radiation exposure to the testicles can often not be avoided with this technique. Embolization is also an effective treatment for post-surgical varicoceles. These are varicoceles that reappear after they have been surgically repaired. The main theory is the presence of redundant gonadal veins that provide collateralization cause the reappearance of the varicoceles.

Assisted reproduction

Assisted reproductive technology (ART), including in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI), is routinely used to treat male factor infertility. Because of the success of ART, the optimal method to achieve pregnancy with male infertility has been debated. Decision analysis-based comparisons of ART and varicocelectomy suggest that varicocele repair is more cost-effective than the use of ART in men with impaired semen parameters, which should be taken into consideration in patient care. In addition, the indication of
varicocele repair prior to IVF/ICSI may be considered in certain circumstances. Men with non-obstructive azoospermia (NOA) and favourable testicular histopathology may resume sperm production following repair of clinical varicocele. Sperm restoration, even if minimal, yields the possibility of IVF/ICSI without the need of sperm retrieval techniques (SRT). It has been shown that for patients who are still azoospermic after varicocelectomy, SRT success rates using testicular microdissection sperm extraction (TESE, micro-TESE, PESA, MESA), and as a result, the couple's chance for pregnancy may be increased. Sperm donation is the only choice to became a parent when no spermatozoa are obtained even after surgical sperm retrieval.

Find more about related issues

Diagnoses

Azoospermia
Complete absence of sperm in the ejaculate of a man.
Learn more at: www.fertilitypedia.org/therapy/diag/azoospermia

Erectile dysfunction
The inability (that lasts more than 6 months) to develop or maintain an erection of the penis during sexual activity.
Learn more at: www.fertilitypedia.org/therapy/diag/erectile-dysfunction

Obesity
A disease of excess body fat that can have a negative effect on health, leading to reduced life expectancy and other health problems.
Learn more at: www.fertilitypedia.org/therapy/diag/obesity

Non-obstructive azoospermia
Complete absence of sperm in the ejaculate due to testicular failure.
Learn more at: www.fertilitypedia.org/therapy/diag/non-obstructive-azoospermia

Oligozoospermia
Semen with a low concentration of sperm and is a common finding in male infertility.
Learn more at: www.fertilitypedia.org/therapy/diag/oligozoospermia
Hypogonadism
A medical term which describes a diminished functional activity of the gonads – the testes and ovaries.
Learn more at: www.fertilitypedia.org/therapy/diag/hypogonadism

Sperm autoantibodies
Antibodies that bind to sperm, inhibiting their movement, stopping recognition and entry into the egg.
Learn more at: www.fertilitypedia.org/therapy/diag/sperm-autoantibodies

Benign prostatic hyperplasia
A noncancerous increase in size of the prostate.
Learn more at: www.fertilitypedia.org/therapy/diag/benign-prostatic-hyperplasia

Teratospermia
Teratospermia is a condition characterized by the presence of sperm with abnormal morphology that affects fertility in males.
Learn more at: www.fertilitypedia.org/therapy/diag/teratospermia

Globozoospermia
Globozoospermia is characterized by the presence of acrosomeless round-headed spermatozoa with normal chromosomal content.
Learn more at: www.fertilitypedia.org/therapy/diag/globozoospermia

Idiopathic male infertility
A condition in which fertility impairment occurs spontaneously or due to an unknown cause.
Learn more at: www.fertilitypedia.org/therapy/diag/idiopathic-male-infertility

Hypoandrogenism
A medical condition characterized by not enough androgenic activity in the body.
Learn more at: www.fertilitypedia.org/therapy/diag/hypoandrogenism

Testicular atrophy
A medical condition in which the testes diminish in size and may be accompanied by loss of function (production of sperm and testosterone).
Learn more at: www.fertilitypedia.org/therapy/diag/testicular-atrophy
Nutcracker syndrome
A manifest variant of nutcracker phenomenon, renal vein entrapment syndrome, or mesoaortic compression of the left renal vein.
Learn more at: www.fertilitypedia.org/therapy/diag/nutcracker-syndrome

Renal cell carcinoma
A kidney cancer that originates in a part of the very small tubes in the kidney that transport waste molecules from the blood to the urine.
Learn more at: www.fertilitypedia.org/therapy/diag/renal-cell-carcinoma

Organs

Epididymis
The epididymis is a tube that connects a testicle to a vas deferens in the male reproductive system.
Learn more at: www.fertilitypedia.org/edu/organs/epididymis

Testes
Male gonads which produce both sperm and androgens, such as testosterone, and are active throughout the reproductive lifespan of the male.
Learn more at: www.fertilitypedia.org/edu/organs/testes

Reproductive cells

Spermatogonium
An undifferentiated male germ cell with self-renewing capacity representing the first stage of spermatogenesis.
Learn more at: www.fertilitypedia.org/edu/reproductive-cells/spermatogonium

Biological control

Testosterone
Steroid hormone produced primarily in the testes of the male; responsible for the development of secondary sex characteristics in the male.
Learn more at: www.fertilitypedia.org/edu/biological-control/testosterone

Reproductive functions
**Fertilization**
The fusion of an ovum with a sperm to initiate the development of a new individual organism.
Learn more at: [www.fertilitypedia.org/edu/reproductive-functions/fertilization](http://www.fertilitypedia.org/edu/reproductive-functions/fertilization)

**Spermatogenesis**
Process in which spermatozoa are produced from male primordial germ cells in testicles by way of mitosis and meiosis.
Learn more at: [www.fertilitypedia.org/edu/reproductive-functions/spermatogenesis](http://www.fertilitypedia.org/edu/reproductive-functions/spermatogenesis)

⚠️ **Risk factors**

**Constipation**
Infrequent or difficult evacuation of the bowels.
Learn more at: [www.fertilitypedia.org/therapy/rf/constipation](http://www.fertilitypedia.org/therapy/rf/constipation)

**Low level of testosterone**
An abnormally low testosterone production which may occur because of testicular or hypothalamic-pituitary dysfunction.
Learn more at: [www.fertilitypedia.org/therapy/rf/low-level-of-testosterone](http://www.fertilitypedia.org/therapy/rf/low-level-of-testosterone)

**Over-exercise**
A common term for any practice of, or training for, a concrete sport which is in excess of that necessary to effectively participate in the sport.
Learn more at: [www.fertilitypedia.org/therapy/rf/over-exercise](http://www.fertilitypedia.org/therapy/rf/over-exercise)

**Oxidative stress**
Disturbance in the balance of free radicals and antioxidant defenses which can affect oocyte maturation, fertilization, and embryo development.
Learn more at: [www.fertilitypedia.org/therapy/rf/oxidative-stress](http://www.fertilitypedia.org/therapy/rf/oxidative-stress)

**Testicular or scrotal injury**
Damage of the testicles or scrotum which may be temporary or permanent.
Learn more at: [www.fertilitypedia.org/therapy/rf/testicular-or-scrotal-injury](http://www.fertilitypedia.org/therapy/rf/testicular-or-scrotal-injury)

**Tight clothing**
Type of clothes, that fit very tightly and may result in decreased fertility.
Learn more at: [www.fertilitypedia.org/therapy/rf/tight-clothing](http://www.fertilitypedia.org/therapy/rf/tight-clothing)

⚠️ **Symptoms**
Abnormal sperm morphology
A normal sperm morphology of less than 4% of sperms in an ejaculate.
Learn more at: www.fertilitypedia.org/edu/symptoms/abnormal-sperm-morphology

Absence of sperm in ejaculate
The medical condition of a man whose semen contains no sperm.
Learn more at: www.fertilitypedia.org/edu/symptoms/absence-of-sperm-in-ejaculate

Atrophy of the testicles
A not-temporary condition in which the testes diminish in size and may be accompanied by loss of function.
Learn more at: www.fertilitypedia.org/edu/symptoms/atrophy-of-the-testicles

Immobile or dead spermatozoa in semen
A condition in which spermatozoa in semen are either immobile or dead.
Learn more at: www.fertilitypedia.org/edu/symptoms/immobile-or-dead-spermatozoa-in-semen

Infertility
The failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse.
Learn more at: www.fertilitypedia.org/edu/symptoms/infertility

Low concentration of sperm
A condition refers to semen with a low concentration of sperm.
Learn more at: www.fertilitypedia.org/edu/symptoms/low-concentration-of-sperm

Reduced sperm motility
The decreased ability of sperm cell to move progressively.
Learn more at: www.fertilitypedia.org/edu/symptoms/reduced-sperm-motility

Testicular pain
A discomfort felt in the testicles (testes) or scrotum.
Learn more at: www.fertilitypedia.org/edu/symptoms/testicular-pain

Twisted mass in scrotum felt like a bag of worms
Diagnostic symptom of varicocele after palpation of the scrotum.
Learn more at: www.fertilitypedia.org/edu/symptoms/twisted-mass-in-scrotum-felt-like-a-bag-of-worms
Therapies

Egg donation
Process by which a woman donates eggs for purposes of assisted reproduction or biomedical research.
Learn more at: www.fertilitypedia.org/edu/therapies/egg-donation

ICSI
A micromanipulative fertilization technique in which a single sperm is injected directly into an egg.
Learn more at: www.fertilitypedia.org/edu/therapies/icsi

Percutaneous embolization of varicocele
Embolization is a nonsurgical, minimally invasive procedure of varicocele treatment.
Learn more at: www.fertilitypedia.org/edu/therapies/percutaneous-embolization-of-varicocele

Pharmacotherapy of varicocele
Medical treatment of varicocele.
Learn more at: www.fertilitypedia.org/edu/therapies/pharmacotherapy-of-varicocele

Sperm donation
The procedure in which a man (sperm donor) provides his sperm for fertility treatment.
Learn more at: www.fertilitypedia.org/edu/therapies/sperm-donation

Standard IVF
A process in which an egg is fertilised by sperm outside the body: in vitro. Own or donated gametes may be used.
Learn more at: www.fertilitypedia.org/edu/therapies/standard-ivf

Traditional Chinese medicine
A broad range of medicine practices sharing common concepts which have been developed in China and are based on a tradition of more than 2000 years.
Learn more at: www.fertilitypedia.org/edu/therapies/traditional-chinese-medicine

Varicocelectomy
Surgical correction of a varicocele involving ligation of testicular veins.
Learn more at: www.fertilitypedia.org/edu/therapies/varicocelectomy
Pic. 1: Normal testicles vs Comparison of normal veins and veins with varicocele.

Testicular veins
Anatomical image of spermatic veins.

Varicocele
Significant varicocele on the left side.

Algorithm for varicocele treatment
Algorithm for Varicocele Management.

Ultrasound image of varicocele
Ultrasound image of testicular veins with varicocele.
“Treatment of Bilateral Varicocele and Other Scrotal Comorbidities Using a Single Scrotal Access: Our Experience on 34 Patients” —by Iacono et al. licensed under CC BY 3.0

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