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## A. TESTIS AND SCROTUM

### What is testis and scrotum?

**The testes** or male gonads are important parts of male reproductive system. They are paired oval organs located between upper thighs suspended by the spermatic cord in a skin pouch called **scrotum**. The scrotal skin is corrugated because of underlying muscle called dartos. In the fluid filled membranous layers lies the testis. Both testes develop in the abdomen during the development in the womb and then descend to their permanent position later. The testicular temperature is about  $3-4^{\circ}\text{C}$  below the core body temperature. Adjacent to testis is a coiled tube called **epididymis** that serves to store, mature and transport sperm between the testis and vas deferens ( a thick muscular tube to carry sperm). Each testis produces male hormone testosterone (a steroid hormone) and sperm (spermatozoa).

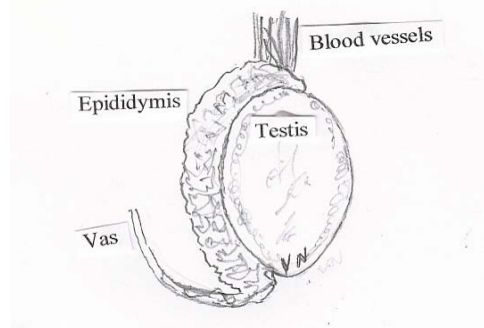


Figure 1: Testis and its appendages

**Spermatogenesis:** Each testis is subdivided into hundreds of coiled tubules known as seminiferous tubules (ST) which are production houses of spermatozoa ( also called sperm). Spermatogenesis is essentially an elaborate cell differentiation process starting with spermatogonia (germ cell) which line the ST and ending as a highly specialized motile cell spermatozoa containing half the number of chromosomes. Each tubule is lined with germ cells which progress to become sperm (Figure 2). STs also contain special cells called Sertoli cells (Figure 3) which support the lining of ST and help in maturation of sperm. Sertoli cells are crucial for sperm development.

Sperm leave the testis through epididymis into vas which join with the seminal vesicles near prostate opening ultimately into prostate. The secretions from seminal vesicles and prostate (see below) mix with the sperm to make up the volume of semen during ejaculation.

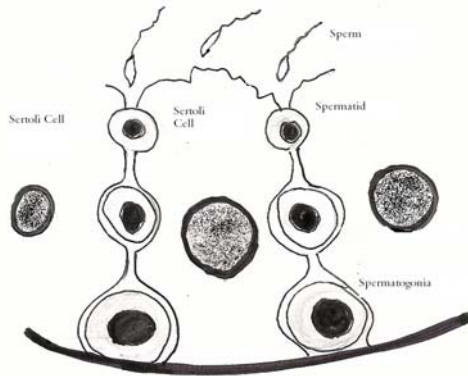
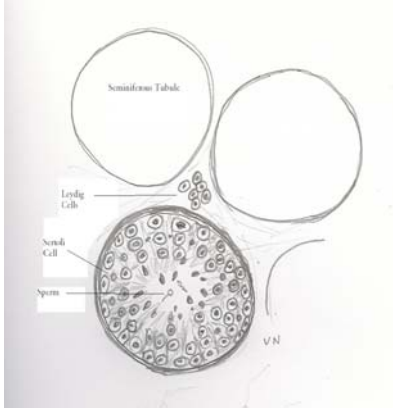


Figure 2: Seminiferous Tubule showing Sertoli Cell nursing various stages of sperm development sperm

Figure 3: Sertoli developing

**Other organs concerned with male reproductive system (Figure 4):**

Seminal vesicles: They are 2 glands at the base of the bladder and connected to the prostate. Like prostate they provide nutrients for the sperms

Prostate: It is walnut sized gland situated below the bladder in front of the rectum and behind the pubic bone. It is closely linked with the urinary system. It secretes much of the liquid portion of the seminal fluid

Urethra: It is the tube (duct) that carries urine from the bladder and sperm from the prostate out through the penis.

Urinary bladder: Although urinary bladder is not related to the reproductive system its continuity with urethra makes an important adjacent organ. It is a hollow, muscular and distensible organ above the prostate on the pelvic floor. The urinary bladder is responsible for storage and evacuation of urine. The ureters are two hollow muscular tubes that connect kidney and bladder.

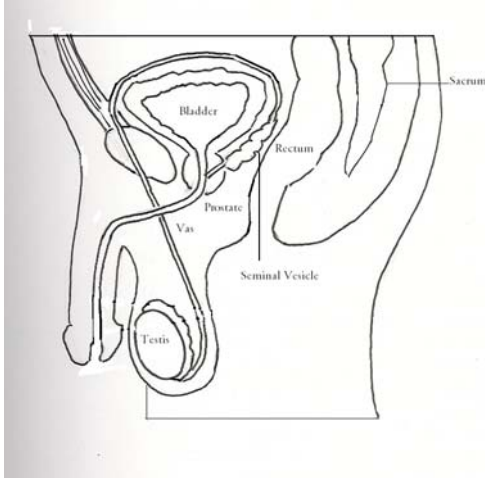


Figure 4 : Male genito-urinary system

### **What is the role of testosterone?**

**Testosterone** and its more potent product **Dihydrotestosterone** are called **androgens**. Testosterone is responsible for the regulation of pituitary hormones (LH and FSH) initiation and maintenance of sperm production. Androgens help with sexual differentiation in embryo. Later in life they help to mature sexual organs and give sexual characteristic features. They increase bone density and muscle mass. They also have a role in bodily, spiritual, self-confidence and mood aspects of the mind. The influence of androgens on red blood cell production is well known. There is a progressive decline in androgen production with aging. This phenomenon is termed as andropause, male climacteric or progressive or partial androgen deficiency of the aging male.

Other hormones of Testis: Sertoli cells produce a hormone called **inhibin** which regulates **Follicle Stimulating Hormone** (FSH) in men.

### **B. DISEASES OF TESTIS**

**What are the disorders of testes and scrotum?**

### **Testis and Epididymis:**

i. Developmental: Birth defects like absent testis, undescended testis, chromosomal abnormalities, absent vas and sexual differentiation; Cysts of epididymis: Blockage of the tubes leading to collection of fluid

ii. Inflammatory and infections: (Called orchitis)

Viral: mumps, Coxsackie, Marburg, choriomeningitis, Dengue

Specific bacterial: Gonococcal, Syphilis, Chlamydia trachomatis, Escherichia coli,

Klebsiella pneumoniae, Pseudomonas aeruginosa, Staphylococcus and Streptococcus species

Nonspecific: auto-immune, urinary infections

iii. Trauma: Testicular Injury: Blunt or sharp

iv. Torsion: Twisting of the cord and the testis

v. Hydrocele: Collection of fluid around the testis

vi. Varicocele: Varicose veins (prominent and tortuous veins) of the spermatic cord

vii. Infertility: Inability to impregnate

viii. Tumours: Benign and malignant tumours (Cancers) of the testis

### **C. SCROTUM**

The primary function of scrotum is to provide protection to the testes and help in controlling the temperature inside the sac. The dartos muscle helps in movement of the scrotal skin. It also has hair follicles and, sebaceous and sweat glands. The sebaceous glands secrete sebum, an oily substance providing a fat layer to minimize evaporation of water.

Sebaceous cysts: The ducts of sebaceous glands get obstructed producing cysts.

Scrotal skin infection is similar to skin infection anywhere on the body.

Scrotal skin cancer is fortunately rare and used to be common in chimney sweepers ('soot wart')

### **D. Symptoms of Testicular conditions**

#### **What are the symptoms of testicular diseases?**

Testicular pain; Swelling; Infertility; Non-testicular symptoms like enlargement of breasts, erectile problems, blood in the semen

## E. Acute Conditions of Testis and scrotum

### What are the acute conditions of testis?

*Acute Epididymitis:* Inflammation of epididymis which is situated at the back of the testis. It produces swelling, pain and tenderness in the testis and epididymis. There may be associated discharge from the penis and blood in the semen. The most common cause of epididymitis is urinary tract infection and sexually transmitted diseases. Antibiotics usually relieve the symptoms.

*Torsion of testis:* Torsion is a condition when testis twists within the scrotum which may completely cut off blood supply to that testis. It is an emergency and should be corrected surgically. It is commonly seen in adolescents but can present at any age.

*Testicular cancer:* Although cancerous growth may be silent it can present as sudden testicular pain or swelling. (Please see in the testicular cancer section)

*Injury to testis:* Direct injury to the testis

*Other conditions of testis and scrotum:* Testis is covered by 2 layers of membranes called *tunica vaginalis* with a fluid-filled space in between these 2 layers to allow frictionless movement of the testis.

*Hydrocele:* Excessive collection of fluid in the tunica vaginalis space. In most of the cases the exact cause is not known.

*Varicocele:* Varicosity of veins in the spermatic cord which may interfere with temperature regulation of the testis leading to impairment of spermatogenesis.

*Haematocele:* Blood around the testis

*Pyocele:* Pus around the testis

**Investigations:** Ultrasound of the testis is a valuable investigation in the management of testicular symptoms. Other investigations may include ultrasound of kidneys and bladder.

## F. Male Infertility

For a man to be fertile following requirements are essential:

- a. Genetically correct male gender during development: Human cells contain 46 chromosomes - 22 pairs of autosomes (non-sex chromosomes) and 2 sex chromosomes, XX in the female and XY in the male
- b. Normal sexual and reproductive organs
- c. Normal hormone function (Endocrine function) of the testis and associated organs like pituitary
- d. Normal sperm production (Spermatogenesis)

Any abnormalities associated with these will make the person infertile.

### **Causes of Male Infertility:**

- a. Chromosomal Causes: Common causes include Klinefelter Syndrome (47 XXY), XX male Syndrome and XXY syndrome, Y-chromosome abnormalities
- b. Testicular causes: Undescended testis, Varicocele, Orchitis (inflammation/Infection of testis), Injury, Vasal obstruction, Cystic fibrosis mutation, Radiation/Chemotherapy damage to the testis, Drugs that damage testis
- c. Hormones: Disorders of pituitary and testicular hormone activity
- d. Other organs as a cause: Erectile problems, Ejaculatory problems, Vasectomy, nerve injuries, penile abnormalities, coital problems
- e. General health: Liver and Kidney disorders, sickle cell disease
- f. Life style issues: Obesity, smoking, diet, exercise and psychological factors

### **Investigations**

Following investigations are done according to the information gained by clinical assessment. Semen analysis however is the basic and an essential investigation in all cases.

1. Semen analysis: The most recommended collection technique is by masturbation. To make an objective analysis and interpretation several samples at different intervals (at least 4- 6 weeks apart) are necessary. Each sample is collected after a sexual abstinence for 2-3 days prior to collection. If the first semen analysis is normal there is no need for further semen analysis or any other tests unless there is some other indication.

A typical healthy sperm is motile and has head and a tail that is 10 times longer than the head.

**Table 1: WHO Reference criteria for semen analysis (2000)**

Criteria	Reference Value
Volume	2.0ml or more
Liquifaction Time	<60 minutes
pH	≥ 7.2
Sperm concentration	≥ 20 million /ml
Total Sperm number	≥ 40 million/ml
Motility	≥50% grade a* or b** motility; ≥25% progressive motility (Grade a) within 60 minutes of ejaculation
Morphology	15-30%
Vitality	≥ 75% live
White Blood Cells	< 1 million/ml

\* Grade a : rapid progressive motility (moving swiftly in a straight line)

\*\* Grade b: Slow or sluggish progressive motility

**Table 2: Definitions**

a	Normozoospermia	Normal parameters as defined by WHO reference values
b	Oligozoospermia	Sperm concentration less than WHO reference values
c	Asthenozoospermia	Less than WHO reference values

		for motility
d	Teratozoospermia	Morphology less than WHO reference values
e	Oligo-astheno-tertozoospermia	Combination of b, c, and d
f	Azoospermia	Absence of sperm in the ejaculate
g	Aspermia	No ejaculate

Antisperm antibodies (ASA): Sometimes sperm clump into aggregates which may be non-specific (e.g. infection or excessive debris) or in site specific manner (e.g. head to head, head to tail or tail to tail or any of these in combination). Site specific manner indicates an immunological cause and can be further investigated by immunobead test or mixed agglutination reaction test (MAR test). However this is little practical importance as the treatment is by assisted conception (IVF or ICSI).

2. Hormone profile: Pituitary and testicular hormone function is assessed by estimation of Luteinising hormone (LH), follicle stimulating hormone (FSH) and testosterone. Following are the indications:

- a. Oligospermia/Azoospermia
- b. Impaired sexual function
- c. Evidence endocrine disorder

3. Urine analysis: A simple midstream urinalysis may indicate infection, blood glucose and protein in the urine.

4. Ultrasound of testis: It is not necessary to carry out ultrasound in every patient presenting with infertility. It is mainly indicated to detect varicocele, to study the testis in presence of hydrocele. It is important to carry out ultrasound in patients who had history of undescended testis and atrophic testis.

5. Chromosomal analysis: Male infertility could be the first sign of genetic abnormality. A number of men with oligospermia or azoospermia have autosomal or sex chromosomal abnormalities. Karyotyping determines such genetic anomaly and can be carried out by blood test. Chromosomal analysis is indicated in presence of high FSH levels, azoospermia and small testes. Nonpalpable vas deferens indicates cystic fibrosis gene mutation and needs chromosomal analysis.

6. Testicular Biopsy: Although biopsy gives information about architecture of the testis and thereby precise infertility diagnosis arising from the testis, it is not a routine investigation of infertility. It is mainly indicated in azoospermia to differentiate between obstruction and primary testicular failure.

## **G. Testicular Cancer**

Malignant tumours of the testis are rare and usually arise from germ cells. Although the exact cause is not known there are number predisposing factors that have been identified. The recognized risks include undescended testis, familial history, previous history of testicular tumour, atrophic testis

Symptoms of testicular cancer

1. Heavy feeling in scrotum
2. Uneven surface of testis
3. Testicular pain
4. Testicular swelling: Painless or painful
5. Enlargement of breasts (gynaecomastia)

Testicular tumours are diagnosed by clinical assessment, ultrasound examination of testes and blood estimation of tumour markers.

**This information is not a substitute for clinical assessment and treatment. This is an educational material and advice from your general practitioner or specialist is extremely important.**

## **D. SELF EXAMINATION OF TESTES**

### **Why should I examine my testes?**

As testes are positioned in the scrotum, examination of testes is straightforward and easy. It takes just a couple of minutes for self-examination. Although testicular cancer is rare, it is one of the most common cancers in young men (16-32 years). Its cure rates are high

if treated early. Because of their position it is easy to feel the testes.

The best time to examine testes is when the scrotal skin and testes are relaxed usually after a hot bath or shower. Before the physical examination stand in front of a mirror with legs slightly apart to see whether there is anything unusual in their appearance (e.g. swelling). It is quite normal for one testis to be slightly larger than the other and left testis usually hangs lower than the right.

### **How do I examine my testicles?**

Use both hands and gently feel each testis separately one at a time. The testicle is held between the thumb and two to three fingers. Feel for the epididymis, a cord like tubular structure at the back of the testis. Normally testis has a smooth surface and feels firm in consistency.

### **What are the signs I should look for?**

You should look for feeling of any heaviness in scrotum, painless enlargement of testis, a dull ache in the groin or lower abdomen, discomfort in testis or scrotum, any lumps, hard surface on the testis. Sometimes the testis may be absent in the scrotum because it has failed to descend into the scrotum. Presence of any of these findings does not mean that you have testicular cancer- but an indication that you should take this forward with your doctor.

### **What are the signs and symptoms of testicular cancer?**

Apart from swelling of the testis there are other signs which can indicate that some thing is not right- weight loss, night sweats,

breast tenderness, difficulty in breathing, lumps in the neck (see testicular cancer).

**Who are likely to get testicular cancer?**

Men with undescended testis

Small testes

Men whose father or brother had testicular cancer

Men who had operation for undescended testis

**What is to be done if you are worried?**

Do not feel embarrassed about your anxiety and symptoms; Discuss this with your doctor and get an opinion. If he is worried he is likely to refer you to see a Urological Surgeon or may arrange an ultrasound scan