

# INTRODUCTION TO ANDROLOGY

## Definitions

- **Andrology** (from Greek word: Andros =Man) is that branch of Medicine that deals with the male reproductive and sexual functions under physiological and pathological conditions.
- The male reproductive functions include 3 main functions namely erection, ejaculation and fertility.
- **Andrology** include Sexology and Male infertility.
- **Sexology** is defined as subdivision of Andrology which deals with human sexuality:

### Examples

- **Disorders of Sexual maturation:** Delayed Puberty.
- **Disorders of Sexual Response Cycle:** Erectile Dysfunction (Impotence) and Ejaculatory Disorders.
- **Male Infertility** is defined as failure of conception after at least one year of regular unprotected intercourse.

## Anatomy of the male genital system

Male reproductive organs can be classified into:

- **Internal Genital Organs:** Testis, epididymis, vas deferens, seminal vesicles, prostate gland and ejaculatory ducts.
- **External Genital Organs:** Penis and scrotum.

## Anatomy of Internal Genital Organs:

### Epididymis

It is a comma shaped structure overlying the posterior and superior aspects of the testis. It is formed of three parts: head

(upper part), body (middle part) and tail (lower part). It transports sperms from the testis to the vas deferens and acts as a site of sperm maturation and storage.

### **Vas deferens**

It is a muscular tube of about 45 cm length and 2.5 mm diameter. It begins as a continuation of the lower end of the epididymal duct and ends by uniting with the duct of the seminal vesicle to form the ejaculatory duct.

### **Ejaculatory ducts**

They are paired structures which are approximately 2 cm in length and formed by the union of the ampulla of the vas deferens and the duct of the seminal vesicle. Ejaculatory ducts terminate in the posterior wall of the prostatic urethra at the verumontanum.

### **Seminal vesicles**

They are paired organs formed of highly convoluted glandular sac consisting of hollow tubes. The seminal vesicles measure about 4-6 cm in length and 1 cm in width in adults.

### **Prostate**

The Prostate gland is a fibromuscular and glandular organ .It resembles an inverted cone, lying inferior to the bladder .It measures approximately 3 cm from the apex to the base and 3.5 cm across the base.It is divided into 2 lateral lobes and a median lobe. Its acini open directly in the posterior urethra at the prostatic sulcus. It is enclosed within 2 capsules; true

anatomic fibro-muscular capsule and false capsule formed by the surrounding compressed pelvic fascia.

## **Testis**

The testes are ovoid organs suspended by the spermatic cord inside the scrotum. Each testis is about 4.5 cm length, 2.5 cm width and 2 cm in its anteroposterior diameter. The volume of each testis ranges from 15-25 ml and the weight is about 15-25 gm.

- Coverings:
  - Tunica vaginalis: The outer layer.
  - Tunica albuginea: The intermediate thick layer.
  - Tunica vasculosa : The inner vascular layer.
- Contents: The testis is divided by septa into about 250 lobules. Each of these lobules contains 1-4 seminiferous tubules.
- Seminiferous tubules: Contain the germ cells and their supporting Sertoli cells and are surrounded by the interstitium. The interstitium contains Leydig cells and stromal elements (collagen and myoid cells that surround seminiferous tubules).

## **Function of the testis**

1- Spermatogenesis (production of spermatozoa) is the process by which spermatogonia undergo maturation to sperms through formation of primary spermatocytes, secondary spermatocytes and spermatids. It starts after

puberty and takes about 74 days.

2- Secretion of testosterone.

## **Homonal control of testicular function**

Hypothalamus secretes gonadotropins releasing hormone (GnRH), which stimulates the secretion of follicle stimulating hormone (FSH) and luteinizing hormone (LH) from the pituitary .FSH acts on Sertoli cells to control spermatogenesis and LH acts on Leydig cells to produce testosterone.

## **Anatomy of External Genital Organs**

### **Penis**

- It is the male sexual organ. It consist of body (shaft), root (crura) and head (glans).
- Components of the penis: Two corpora cavernosa and one corpus spongiosum.
  - The 2 corpora cavernosa diverge at their proximal ends to form the right and left crura of the penis. Each corpus contains the erectile tissue which is formed blood sinusoids surrounded by smooth muscles. Each corpus is enclosed in a thick fibrous layer called tunica albuginea.
  - The corpus spongiosum is a ventral single cylinder which envelops the urethra in its course along the lower surface of the penis .It expands distally to form the glans.

- Blood supply:
  - Penile artery from the internal pudendal artery.
  - The erectile tissue is drained by small venules into the subtunical plexus, then to deep dorsal vein and lastly to internal pudendal artery.
- Nerve supply:
  - Parasympathetic (S2, 3, 4) mainly responsible for erection.
  - Sympathetic (T12-L3) mainly responsible for ejaculation.

## **Scrotal Sac**

- The sac which encloses the testis and play an important role in the thermoregulation of intratesticular temperature.
- Layers: Skin, Dartos muscle, external spermatic fascia, cremasteric muscle and internal spermatic fascia.

# MALE INFERTILITY

## Definitions

- **Infertility** is defined as failure of conception after at least one year of regular unprotected intercourse.
- **Primary infertility:** if the infertile man has never been able to impregnate his wife before.
- **Secondary infertility:** if the infertile man has been able to impregnate his wife before.

## Incidence

- 15-20% of couples are unable to conceive within one year.
- 30% male factor, 40 % female factor, 20% combined male and female factors and 10% idiopathic.

## Causes of male infertility:

### I. Pretesticular causes (endocrinal infertility)

#### A. Hypothalamic causes:

1. Kallmann's syndrome (Gn RH deficiency).
2. Hypothalamic tumours.

#### B. Pituitary causes:

1. Hypopituitarism.
2. Prolactinoma.

### II. Testicular causes

#### A. Chromosomal and genetic disorders:

1. Klinefelter's syndrome (47XXY).
2. Y- chromosome Microdeletions.

#### B. Non genetic disorders:

1. Varicocele.
2. Cryptorchidism.
3. Testicular torsion.
4. Spermatogenic arrest.
5. Sertoli cell only syndrome.
6. Immotile cilia syndrome.

### **III. Post -testicular causes**

#### **A. Obstructive infertility:**

1. Epididymal obstruction.
2. Vasal obstruction.
3. Ejaculatory duct obstruction.
4. Congenital bilateral absent vas.

#### **B. Coital infertility:**

Sever forms of erectile dysfunction or penile curvature that interfere intravaginal semen deposition.

#### **C. Ejaculatory infertility:**

1. Retrograde ejaculation.
2. Anejaculation.
3. Anorgasmia.

### **IV. Miscellaneous**

1. Infectious causes: Prostatitis, epididymitis.
2. Immunological infertility.
3. Neoplastic causes: Testicular tumours.
4. Medical causes and systemic diseases: Liver diseases and renal failure.
5. Drugs: Chemotherapy, anti-androgens and anabolics.
6. Environmental causes: Pollutions and insecticides.

## **Investigations of male infertility**

### **1. Semen analysis:**

The corner stone for infertile male assessment.

#### **The main normal semen parameters include:**

- \* Abstinence period: 3-5 days (range 2-7 days)
- \* Method of collection: Masturbation.
- \* Volume: 2-6 ml.
- \* Liquefaction time: Within 15-60 minutes.
- \* Consistency: The length of the thread should not exceed 2 cm.
- \* Appearance: Characteristic color and odour.
- \* PH: Alkaline (7.2-7.8).
- \* Sperm concentration: should be 15 million per ml or more.
- \* Sperm Motility: 32% or more progressive motility and 40% or more total motility.
- \* Sperm morphology: normal sperm forms should be 4% or more.
- \* White blood cells (pus cells): less than 1 million / ml.
- \* Red blood cells: absent.
- \* Agglutination: should be less than 10%.

#### **Definitions of semen abnormalities**

- \* Aspermia: No ejaculate.
- \* Hypospermia: Semen volume less than 2 ml.
- \* Hyperspermia: Semen volume more than 6 ml.
- \* Azoospermia: No spermatozoa in the ejaculate even after centrifugation.
- \* Oligozoospermia: Sperm concentration less than 15 million per ml.
- \* Asthenozoospermia: less than 32% of sperms have progressive motility.

- \* Teratozoospermia: normal sperm forms less than 4% .
  - \* Necrozoospermia : all sperms are dead.
  - \* Pyospermia: Pus cells more than 1 million / ml.
  - \* Hemospermia: Presence of RBCs in semen.
2. Hormonal assay for FSH, LH, testosterone and prolactin.
  3. Scrotal ultrasonography to detect varicocele.
  4. Trans-rectal ultrasonography, to study the prostate, seminal vesicles and ejaculatory ducts.
  5. Chromosomal study, to detect chromosomal abnormalities as in Klinefelter's syndrome.
  6. Sperm DNA fragmentation.
  7. CT and MRI for undescended testis.

## **Treatment of male infertility**

### **I. Medical Treatment**

1. Treatment of infection: Antibiotics which pass blood prostatic barrier e.g. doxycycline, quinolone and macrolides.
2. Treatment of immunological infertility: Corticosteroids.
3. Treatment of systemic causes: Hypothyroidism and liver diseases.
4. Treatment of hyperprolactinemia : Bromocriptine and cabergoline .
5. Replacement therapy: FSH (Hm Gh and recombinant FSH) and LH (HCG and recombinant LH) to treat hypo-gonadotrophic hypogonadism (endocrinal infertility).
6. Non-specific treatment: Antioxidants, anti- estrogens e.g. Clomiphene citrate and tamoxifen , aromatase inhibitors e.g. letrozole and mucolytics e.g. ambroxole.

## **II. Surgical Treatment**

1. Varicocelectomy for the varicocele.
2. Epididymovasostomy for epididymal obstruction.
3. Trans- urethral resection for veruomontanum (TUR-Veru) in ejaculatory duct obstruction.

## **III. Assisted Reproductive Technologies (ART)**

1. Artificial insemination using husband's semen (AIH).
2. In Vitro Fertilization (IVF).
3. Intracytoplasmic sperm injection (ICSI).

## **Varicocele**

- Varicocele is an abnormal dilatation of veins of the pampiniform plexus of veins draining the testis (dilatation, thickening and tortuosity).
- Varicocele is the most common and correctable cause of male infertility.
- Varicocele is more common on the left side than the right side.
- There is a predominance for left varicocele due to: The left testicular vein is approximately 8-10 cm longer and left testicular vein drains at right angle into the left renal vein while the right testicular vein drains obliquely into the inferior vena cava.
- Theories of varicocele impact on testicular function are : Heat , metabolites accumulation , elevated oxidative stress and epididymal dysfunction .

### **Clinical grades**

- Grade 1: Palpable during Valsalva's manoeuvre.
- Grade 2: Palpable at rest, but not visible.
- Grade 3: Visible and palpable at rest.
- Subclinical: Not palpable or visible at rest or during Valsalva's manoeuvre, but demonstrable by Duplex examination.

**Diagnosis:** Scrotal duplex.

**Treatment:** Varicocelectomy.

## **Klinefelter's syndrome (47XXY)**

- It is a chromosomal disorder that leads to disturbed chromosomal sex and primary testicular failure.
- It is the most common chromosomal disorders in infertility and most common cause of hypogonadism.
- The patients are tall with gynecomastia, small firm testes, and ill developed secondary sexual characters.
- The semen is azoospermic.
- Chromosomal study (karyotyping) : shows 47XXY.
- Treatment
  - Androgen replacement therapy.
  - Infertility problem can be solved in some patients who have spermatogenic foci by TESE and ICS

# Assisted Reproductive Technologies (ART)

## Definition of ART:

Treatments or procedures that include the handling of human egg, sperm or embryo for the purpose of establishing a pregnancy.

## Methods of ART:

- 1- Artificial insemination
- 2- In Vitro Fertilization ( IVF)
- 3- Intracytoplasmic sperm injection (ICSI)

### 1- Artificial insemination:

- A. Intravaginal insemination.
- B. Intracervical insemination.
- C. Intrauterine insemination (IUI).
- D. Intratubal insemination.

### Intrauterine insemination (IUI):

#### Steps:

1. The ovaries are stimulated to produce more eggs per cycle and ovulation is monitored.
  2. Around the time of ovulation, semen is processed with special media in the laboratory then injected into the uterine cavity by an IUI catheter.
- Semen processing aims at the concentration of normal progressively motile spermatozoa into a small volume of culture fluid, elimination

of seminal plasma. Example of semen processing techniques is Swim Up technique.

**Indications:**

1. Slight deficiency in the number or motility of sperms.
2. Female cervical factors.
3. Unexplained infertility.

**2- In Vitro Fertilization ( IVF):**

The first successful IVF case was in 1978 when a British woman delivered a baby called Louise Brown.

**Steps:**

1. The ovaries are stimulated to produce more eggs per cycle and ovulation is monitored.
2. At the ovulation time, mature eggs are collected through transvaginal U/S guided needle (Ovum Pick Up) under sedation.
3. Eggs are mixed with thousands of sperms in a special dish and incubated in special incubators simulating natural conditions.
4. After fertilization is assured and cell division is observed, 1-3 embryo are transferred to the woman's uterus through the cervix using a special catheter (done 2-5 days after fertilization).

**Indications:**

1. Men with low sperm count, weak motility and /or abnormal morphology.
2. Women with blocked fallopian tubes.
3. Ovulation problems.

4. Unexplained infertility.

### **3- Intracytoplasmic sperm injection (1CSI):**

It is the most common used ART procedure nowadays.

#### **Steps:**

1. After ovarian stimulation, ovulation monitoring and ovum pick u, the ovum is injected with a single sperm .A special needle is used to inject the sperm through the egg wall into the cytoplasm.
2. The fertilized eggs are incubated in special incubators.
3. One or three embryos are transferred into the woman's uterus 2-5 days after fertilization

#### **Indications in males:**

- Severe oligo ,astheno and /or teratozoospermia.
- Azoospermia:
  - In cases of obstructive azoospermia, sperms are retrieved by Testicular Sperm Aspiration (TESA) or Percutaneous Epididymal Sperm Aspiration (PESA).
  - In cases of non-obstructive azoospermia, sperms might be retrieved by Microsurgical Testicular Sperm Extraction (Micro TESE).

#### **Indications in females:**

- Women with blocked fallopian tubes.
- Ovulation problems.

#### **Indications in both males and females:**

- Immune infertility.

- Unexplained infertility.
- Failed IUI trials.

**Complications of ART:**

- 1- Miscarriage (15%).
- 2- Multiple gestation pregnancies (25%).
- 3- Ectopic pregnancy (2-5%).
- 4- Increased the risk of prematurity and C/S.