CHAPTER 19 – MALE REPRODUCTIVE SYSTEM

OBJECTIVES

On completion of this chapter, you will be able to:

- Describe and state the functions of the male’s external organs of reproduction.
- Describe and state the functions of the male’s internal organs of reproduction.
- Analyze, build, spell, and pronounce medical words.
- Comprehend the drugs highlighted in this chapter.
- Provide the description of diagnostic and laboratory tests related to the male reproductive system.
- Identify and define selected abbreviations.
- Describe each of the conditions presented in the Pathology Spotlights.
- Review the Pathology Checkpoint.
- Complete the Study and Review section, and the Chart Note Analysis.

OUTLINE

I. Anatomy and Physiology Overview (Fig 19–1, p. 638)

The male reproductive system consists of the testes, various ducts, the urethra and the accessory glands: bulbourethral, prostate, and the seminal vesicles. The supporting structures and accessory sex organs are the scrotum and the penis. The function of this system is to provide the sperm cells necessary to fertilize the ovum, thereby perpetuating the species.

A. External Organs – the scrotum and penis make up this section.

1. Scrotum (Fig. 19–1, p. 638) – pouchlike structure located behind the penis. It suspends from the perineal region and is divided by a septum into two sacs. Each sac contains one of the testes along with its connecting tube, the epididymis. Within the tissues of the scrotum are fibers of smooth muscle that contract in the absence of sufficient heat, giving the scrotum a wrinkled appearance. This contractile action brings the testes closer to the perineum where they absorb sufficient body heat to maintain the viability of the spermatozoa. Under normal conditions, the walls of the scrotum are generally free of wrinkles, and it hangs loosely between the thighs.

2. Penis – the external male sex organ, composed of erectile tissue covered with skin. The functions of the penis are to serve as the male organ of copulation and as the site of the orifice for the elimination of urine and semen from the body. There are three columns of this erectile tissue that are capable of significant enlargement when engorged with blood, as during sexual stimulation. The blood arises from dilated arteries supplying the penis and filling the cavernous spaces in the erectile tissue. When the arteries constrict, the pressure to area veins is reduced, thus
allowing more blood to leave than enters, and the penis returns to its normal state. The columns are known as:

a. **Corpora Cavernosa Penis** – two columns of erectile tissue located side-by-side to make up the greater part of the penis.

b. **Corpus Spongiosum** – is transversed by the penile portion of the urethra and tends to be more elastic when in an erectile state. It expands to form the:

   - **Glans Penis** (Fig. 19–2, p. 640) – the cone-shaped head of the penis that is the site of the urethral orifice and is covered with loose skin folds called the foreskin or prepuce.
     - **Smegma** – lubricating fluid secreted by glands in the foreskin.
     - **Circumcision** – the surgical removal of the foreskin.

**B. Internal Organs** – the testes, the epididymis, the vas deferens, the seminal vesicles, the prostate gland, the bulbourethral glands, and the urethra are the internal organs of reproduction.

1. **Testes** (Fig 19–3, p. 641) – two ovoid-shaped organs located in the scrotum. The interior of each testis is divided into about 250 wedge-shaped lobes by fibrous tissues.

   a. **Seminiferous Tubules** (Figs. 19–1 and 19–2, pp. 638, 640) – form a plexus or network called the rete testis from which 15 to 20 small ducts, the efferent ductules, leave the testis and open into the epididymis.

   b. **Spermatozoa** – the male reproductive cell, which is developed within the seminiferous tubules.

   c. **Testosterone** – male sex hormone produced by cells in the testes. Testosterone is responsible for the
      - Development of secondary male characteristics during puberty.
      - Growth and development of the male accessory sex organs.
      - Erection process of the penis that is necessary for copulation.
      - Growth of hair on the face, muscular development, and vocal timbre.

2. **Epididymis** (Fig. 19–4, p. 641) – a coiled tube laying on the posterior aspect of the testis. It is between 13 and 20 feet in length but is coiled into a space less than 2 inches long and ends in the vas deferens. Each epididymis functions:

   a. As a storage site for the maturation of sperm (Fig. 19–4, p. 641).
b. As the first part of the duct system through which sperm pass on their journey to the urethra (Figs. 19–1 and 19–2, pp. 638, 640).

3. **Vas Deferens or Ductus Deferens** – a slim muscular tube that is the continuation of the epididymis. It is the excretory duct of the testes and extends from a point adjacent to the testis to enter the abdomen through the inguinal canal. It is later joined by the duct from the seminal vesicle. Between the testis and the internal inguinal ring, the vas deferens is contained within a structure known as the spermatic cord that also contains arteries, veins, lymphatic vessels, and nerves.

4. **Seminal Vesicles** – two in number, the seminal vesicles each connected by a narrow duct to a vas deferens, which then forms a short tube, the ejaculatory duct, which penetrates the base of the prostate gland and opens into the prostatic portion of the urethra. The seminal vesicles produce a slightly alkaline fluid that becomes a part of the seminal fluid or semen.

5. **Prostate Gland** – is about 4 cm wide and weighs about 20 g. It is composed of glandular, connective, and muscular tissue and lies behind the urinary bladder. It surrounds the first 2.5 cm of the urethra and secretes an alkaline fluid that aids in maintaining the viability of spermatozoa.
   a. **Benign Prostatic Hyperplasia** – enlargement of the prostate gland, a condition seen in older men. When enlarged, the prostate obstructs the urethra and interferes with the normal passage of urine.
   b. **Prostatectomy** – removal of part or all of the prostate gland in cases of enlargement or cancer.

6. **Bulbourethral or Cowper’s Glands** – two small pea-sized glands located below the prostate and on either side of the urethra. A small duct connects them with the wall of the urethra. Their purpose is to produce a mucous secretion before ejaculation, which becomes a part of the semen.

7. **Urethra** – serves the function of transmitting urine and semen out of the body. It extends from the urinary bladder to the external urethral orifice at the head of the penis. It is divided into three sections:
   a. **Prostatic**
   b. **Membranous**
   c. **Penile**

II. **Life Span Considerations**

A. **The Child** – the testicles of a newborn may appear large at birth. Other birth and/or adolescent observations include:
   1. **Cryptorchidism** – the failure of the testicles to descend into the scrotum.
2. **Phimosis** – a condition of narrowing of the opening of the prepuce wherein the foreskin cannot be drawn back over the glans penis.

3. **Epispadias (Fig. 19–7, p. 645)** – a congenital defect in which the urethra opens on the dorsum of the penis.

4. **Hypospadias (Fig. 19–7, p. 645)** – a congenital defect in which the urethra opens on the underside of the penis

**Puberty** – a period of rapid growth in the lives of boys and girls. In the male child, the genitals increase in size and the shoulders broaden and become muscular. The following secondary sex characteristics develop as testosterone is released:

- Pubic and axillary hair
- Increase in size of penis and testes
- Voice change
- Facial hair
- Erections
- Nocturnal emissions

**B. The Older Adult** – the prostate gland enlarges with age and glandular secretions decrease. The testes become smaller and firmer. Testosterone production decreases; therefore, pubic hair becomes sparse and stiff. This period of change in the male has been referred to as the **male climacteric** and can be associated with symptoms such as:

- Hot flashes
- Feelings of suffocation
- Insomnia
- Irritability
- Emotional instability

Testosterone replacement therapy may be recommended for these symptoms. **Spermatogenesis** and the ability to have erections last a lifetime; however, sexual arousal is slower with a longer **refractory period**.

### III. Building Your Medical Vocabulary

**A. Medical Words and Definitions** – this section provides the foundation for learning medical terminology. Medical words can be made up of four types of word parts:

1. **Prefix (P)**
2. **Root (R)**
3. **Combining Forms (CF)**
4. **Suffixes (S)**

By connecting various word parts in an organized sequence, thousands of words can be built and learned. In the text, the word list is alphabetized so one can see the variety of meanings created when common prefixes and suffixes are repeatedly applied to certain word roots and/or combining forms. Words shown in *pink* are additional words related to the content of this chapter that have not been divided into word parts. Definitions
identified with an asterisk icon (*) indicate terms that are covered in the Pathology Spotlights section of the chapter.

IV. Drug Highlights
A. Testosterone – responsible for growth, development, and maintenance of the male reproductive system and secondary sex characteristics.

1. Therapeutic Use – may be use in the following cases:
   a. Replacement therapy in primary hypogonadism and to stimulate puberty in carefully selected males.
   b. To relieve symptoms of the male climacteric due to androgen deficiency.
   c. To help stimulate sperm production in oligospermia.
   d. Used when impotence is due to androgen deficiency.
   e. For advanced inoperable metastatic breast cancer in women who are 1 to 5 years postmenopausal.

2. Patient Teaching – educate the patient to be aware of possible adverse reactions and report any of the following to the physician:
   a. All Patients – nausea, vomiting, jaundice, edema.
   b. Males – frequent or persistent erection of the penis
   c. Females – hoarseness, acne, changes in menstrual periods, growth of hair on face and/or body.

3. Special Considerations
   a. Diabetic Patients – the effects of testosterone can decrease blood glucose and insulin requirements.
   b. Patients on Anticoagulants – testosterone can decrease the anticoagulant requirements of patients receiving oral anticoagulants. These patients require close monitoring when testosterone therapy is begun and then when it is stopped.
   c. Anabolic Steroids (testosterone) – can be abused by individuals who seek to increase muscle mass, strength, and overall athletic ability. This form of use is illegal and signs of abuse may include the following:
      • Flulike symptoms
      • Headaches
      • Muscle aches
      • Dizziness
      • Bruises
      • Needle marks
      • Increased bleeding (nosebleeds, petechiae, gums, conjunctiva)
      • Enlarged spleen, liver, and/or prostate
      • Edema
      • And in the female: increased facial hair, menstrual irregularities, and enlarged clitoris.
V. Diagnostic and Lab Tests

A. Fluorescent Treponemal Antibody Absorption – test performed on blood serum to determine the presence of *Treponema pallidum* to detect syphilis.

B. Paternity Test – to determine whether a certain man is the father of a specific child. The most common and accurate test used is the DNA test. This test compares a child’s DNA pattern with that of the alleged father to check for evidence of inheritance. Result is either exclusion (not the father) or inclusion (is the father). The mother’s participation helps exclude half of the child’s DNA, leaving the other half for comparison with the alleged father’s DNA. A buccal (cheek) sample is taken from each participating person. Most states have laws that require an unmarried couple to fill out an Acknowledgement of Paternity (AOP) form to legally establish the identity of the father.

C. Prostate-Specific Antigen Immunoassay (PSA) – blood test that measures concentrations of a special protein known as prostate-specific antigen. An increased level indicates prostate disease or prostatic cancer.

D. Semen Sampling – test performed on semen that looks at the volume, pH, sperm count, sperm motility, and morphology to evaluate infertility in men.

E. Testosterone Toxicology – test performed on blood serum to identify the level of testosterone in the body. Increased level can indicate benign prostatic hyperplasia. Decreased level can indicate hypogonadism, testicular hypofunction, hypopituitarism, and/or orchidectomy.

F. Venereal Disease Research Laboratory (VDRL) – test performed on blood serum to determine the presence of *Treponema pallidum* to detect syphilis.

VI. Abbreviations (p. 650)

VII. Pathology Spotlights

A. Benign Prostatic Hyperplasia (BPH) or Benign Prostatic Hypertrophy (Fig.19–11, p. 651) – an enlargement of the prostate gland that can occur in men who are 50 years of age and older. A microscopic exam of the prostate tissue will reveal if the prostate is enlarged due to the hypertrophy (enlargement of individual cells), or if it is due to hyperplasia (more cells being present). By age 60, four out of five men have an enlarged prostate. As the prostate enlarges, it compresses the urethra, thereby restricting the normal flow of urine. This restriction generally causes a number of symptoms and can be referred to as prostatism, any condition of the prostate gland that interferes with the flow of urine from the bladder. Symptoms usually include:

- Weak or hard-to-start urine stream
- Feeling that the bladder is not empty
- Need to urinate often, especially at night
• Feeling of urgency (a sudden need to urinate)
• Abdominal straining; a decrease in size and force of the urinary stream
• Interruption of the stream
• Acute urinary retention
• Recurrent urinary infections

Treatment for benign prostatic hyperplasia can include:

1. **Drug Therapy** – oral medications prescribed to help relieve the symptoms of BPH. Proscar (finasteride) lowers the levels of dihydrotestosterone (DHT), which is a major factor in enlargement of the prostate. Other medications include Hytrin (terazosin), Cardura (doxazosin), and Flomax (tamsulosin) which act by relaxing the smooth muscle of the prostate and bladder neck to improve urine flow and to reduce bladder outlet obstruction.

2. **Nonsurgical Treatment** – used when drug therapy is not effective. Two of these procedures are:
   a. **Transurethral Microwave** – procedure that uses a device known as the Prostatron. This device uses microwaves to heat and destroy excess prostate tissue. The procedure, which is called transurethral microwave thermotherapy (TUMT), uses the Prostatron to send computer-regulated microwaves through a catheter to heat selected portions of the prostate to at least 111 degrees Fahrenheit. A cooling system protects the urinary tract during the procedure. The procedure takes about 1 hour and can be performed on an outpatient basis without general anesthesia. There is no record of this procedure leading to impotence or incontinence.

   b. **Transurethral Needle Ablation (TUNA)** – a minimally invasive treatment for BPH that delivers low-level radiofrequency energy through twin needles to burn away a well-defined region of the enlarged prostate. Shields protect the urethra from heat damage. The TUNA System improves urine flow and relieves symptoms with fewer side effects when compared with transurethral resection of the prostate (TURP). There has been no indication of incontinence or impotence using this system.

3. **Surgery**
   a. **Transurethral Resection of the Prostate (TURP or TUR)** – most common form of surgery used for benign prostatic hyperplasia. An endoscopic instrument that has ocular and surgical capabilities is introduced directly through the urethra to the prostate and small pieces of the prostate gland are removed by using an electrical cutting loop.
b. Transurethral Incision of the Prostate (TUIP) – used to widen the urethra by making a few small cuts in the bladder neck, where the urethra joins the bladder, and in the prostate gland itself.

c. Open Surgery – used when a transurethral procedure cannot be done. Often performed:
   - When the gland is greatly enlarged.
   - When there are complicating factors.
   - When the bladder has been damaged and needs to be repaired.

d. Laser Surgery – employs side-firing laser fibers and ND: YAG (Neodimium Doped Yttrium Aluminum Garnet) lasers to vaporize obstructing prostate tissue.

B. Erectile Dysfunction (ED) (Table 19–1, p. 653) – the inability to achieve or maintain an erection sufficient for sexual intercourse. It occurs when not enough blood is supplied to the penis, when the smooth muscle in the penis fails to relax, or when the penis does not retain the blood that flows into it. Although the likelihood of erectile dysfunction increases with age, it is not an inevitable part of aging. About 80% of erectile dysfunction has a physical cause. Risk factors for ED include:
   - Hypertension
   - Hyperlipidemia
   - Endocrine disorders
   - Low testosterone (such as patients receiving hormonal therapy for prostate cancer or patients with hypogonadotrophic hypogonadism)
   - Thyroid disease
   - Diabetes mellitus
   - Coronary artery disease
   - Peripheral vascular disease
   - Anemia
   - Medications
   - Smoking and alcohol abuse
   - Surgical procedures – (vascular surgeries or radical prostatectomy)
   - Neurological conditions
   - Psychiatric illness including anxiety disorder, depression or obsessive-compulsive disorder
   - Injury

There are many treatment options for ED including:
   - Emotional-Based ED – counseling or sex therapy.
   - Physical-Based ED – cause specific.
   - Vacuum Constriction Device (VCD)
   - Oral Medications
   - Medication Patches and Gels
   - Urethral and Penile Injection Therapies
• Surgical Therapies – such as penile prostheses or implants.

C. Prostate Cancer – the most common type of cancer found in men and the second leading cause of death in men; is a malignant tumor that grows in the prostate gland. Up to one in four men have some cancerous cells in the prostate gland by age 50 with the ratio increasing to one in two by age 80. In the United States, the average age of diagnosis is 70. Diagnosis of prostate cancer can be confirmed with:

1. Medical History
2. Physical Examination – should include a rectal exam to assess the size and condition (firm, soft, hard) of the prostate gland.
3. PSA Blood Test Results

Some men with prostate cancer have no symptoms; others notice symptoms including but not limited to:

• Dull pain in the lower pelvic area
• General pain in the lower back, hips, or upper thighs
• Blood in the urine or semen
• Dribbling when urinating
• Erectile dysfunction
• Frequent urination, especially at night
• Painful urination and/or ejaculation
• Smaller stream of urine and/or an urgent need to urinate
• Loss of appetite and weight
• With metastasis, persistent bone pain
• Nerve paralysis or loss of bladder function

Prostate cancer is graded and staged for aggressiveness based on how far it has spread throughout the body. CT scans and bone scans help in staging. Sometimes staging only becomes clear at the time of surgery. Following are the stages of prostate cancer:

a. Stages A and B – cancer confined to the prostate gland.
b. Stage C – cancer has spread to other tissues near the prostate gland.
c. Stage D – cancer has spread to lymph nodes or sites in the body a distance away from the prostate.

The proper management of the many stages of prostate cancer is controversial; so depending on the grade and stage of the cancer, the options can include any of the following:

• Chemotherapy
• Cryosurgery to freeze cancer cells
• External radiation to the prostate and pelvis
• Hormone therapy
• Radioactive implants put directly into the prostate, which slowly kill cancer cells
• Surgery to remove part or all of the prostate and surrounding tissue
- Surgical removal of the testicles to block testosterone production
- Watchful waiting and monitoring only

A significant number of prostate cancer patients use complementary and alternative medicines (CAM) as part of their treatment, according to a new study. But many of those men don’t tell their doctors about these therapies, which could have a negative effect on their care.

D. Sexually Transmitted Diseases (STDs) – sexual diseases, which can occur in men, women, and children, are passed from person to person through sexual contact or from mother to child. The following is a summary of the most common sexually transmitted diseases:

1. **Chlamydia** – caused by the *Chlamydia trachomatis* bacterium and is treated with antibiotics such as tetracycline or erythromycin. Chlamydia may present in the following manners:
   a. **Males** – mucopurulent discharge from penis, burning, itching in genital area, dysuria, swollen testes; can cause nongonococcal urethritis (NGU) and sterility.
   b. **Females** – mucopurulent discharge from vagina, cystitis, pelvic pain, cervicitis; can lead to pelvic inflammatory disease (PID) and sterility.
   c. **Newborns** – eye infection or pneumonia; can cause death.

2. **Genital Warts (Fig. 19–6, p. 644)** – caused by the human papillomavirus (HPV); treated laser surgery, chemotherapy, cryosurgery, or cauterization. Genital warts can present with the following symptoms:
   a. **Males** – cauliflowerlike growths on the penis and perianal area.
   b. **Females** – cauliflowerlike growths around vagina and perianal area.
   
   **Note:** A vaccine, Gardasil®, licensed by the Food and Drug Administration (FDA) can be given to prevent cervical cancer and other diseases in females (ages 9-26 years) which are caused by certain types of *genital human papillomavirus (HPV)*. The vaccine protects against four HPV types, which are responsible for 70% of cervical cancers and 90% of genital warts.

3. **Gonorrhea** – caused by the *Neisseria gonorrhoeae* bacterium and is treated with antibiotics such as tetracycline or penicillin. Symptoms or conditions produced include:
   a. **Male** – purulent urethral discharge, dysuria, urinary frequency.
   b. **Female** – purulent vaginal discharge, dysuria, urinary frequency, abnormal menstrual bleeding, abdominal tenderness; can lead to PID and sterility.
c. **Newborn** – gonorrheal ophthalmia neonatorum, purulent eye discharge, and can cause blindness.

4. **Herpes Genitalis** – caused by the *herpes simplex virus-2 (HSV-2)* of which there is no known cure. HSV-2, however, can be treated with the antiviral drug acyclovir (*Zovirax*) to relieve symptoms during acute phase. General symptoms include:
   - Flulike symptoms
   - Fever
   - Headache
   - Malaise
   - Anorexia
   - Muscle pain

Active phase symptoms are:
   a. **Male** – fluid-filled vesicles (blisters) on penis, which may rupture causing acute pain and itching.
   b. **Female** – blisters in and around vagina.
   c. **Newborns** – can be infected during vaginal delivery resulting in severe infection, physical and mental damage.

5. **Syphilis** (*Figs. 19–12 and 19–13, p. 655*) – caused by the *Treponema pallidum* bacterium and is treated with the antibiotics penicillin, tetracycline, or erythromycin. The symptoms of syphilis presents in different stages as follows:
   a. **Primary Stage** – chancre (painless ulcer of syphilis) at point of infection:
      - **Males** – penis, anus, and/or rectum.
      - **Females** – vagina and cervix.
      - **Both** – lips, tongue, fingers, or nipples.
   b. **Secondary Stage** – flulike symptoms with a skin rash over moist, fatty areas of the body.
   c. **Late Stage** – difficulty coordinating muscle movements, paralysis, numbness, gradual blindness, and dementia. This damage can be serious enough to cause death.
   d. **Newborns** – known as congenital syphilis; can result in heart defect, bone or other deformities.

6. **Trichomoniasis** – caused by a parasitic protozoa *Trichomonas* and is treated with Metronidazole (*Flagyl*). The symptoms will include:
   a. **Male** – usually asymptomatic but can lead to cystitis, urethritis, prostatitis, and nongonococcal urethritis (NGU).
   b. **Female** – white frothy vaginal discharge, burning and itching of vulva and can lead to cystitis, urethritis, and vaginitis.

E. **Vasectomy** (*Fig. 19–10, p. 648*) – surgical procedure in which the vas deferens are tied off and cut apart resulting in permanent sterility by preventing transport of sperm out of the testes. This procedure is permanent, therefore it is not recommended as a temporary or reversible
procedure. After vasectomy, the sperm count gradually decreases with sperm no longer present in the semen after approximately 4 to 6 weeks. This surgery does not affect the man’s ability to achieve orgasm, ejaculate, or achieve erections. There is still a fluid ejaculate, but no sperm is in this fluid, so the man cannot impregnate his partner. A semen specimen must be examined and found to be totally free of sperm a month or more after vasectomy before the patient can rely on the vasectomy for birth control.

VIII. Pathology Checkpoint

IX. Study and Review (pp. 658–663)

X. Practical Application: SOAP: Chart Note Analysis