Toppersnotes
Unleash the topper in you

A to Z

NURSING OFFICER EXAM

For All State NHM, CHO & Nursing Officer Exams

Volume - 3

SIERRA INNOVATIONS

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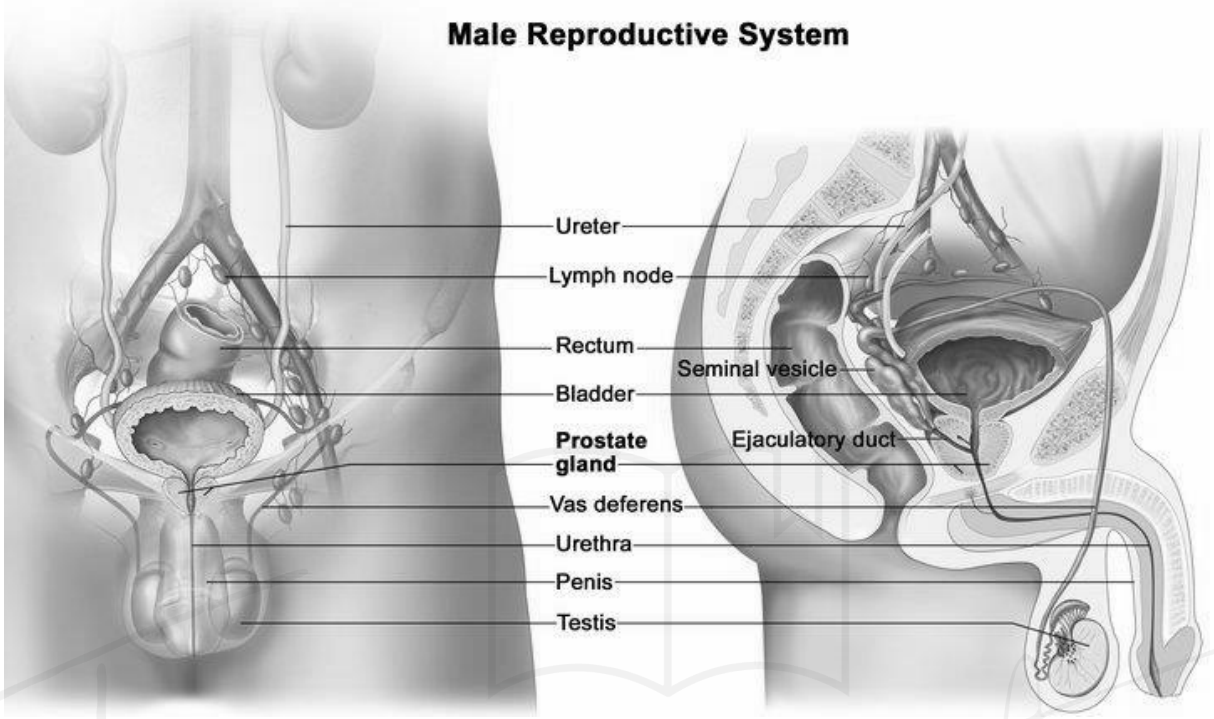
1 CHAPTER

Male Reproductive System

The **male reproductive system** is responsible for the production of sperm (spermatogenesis), transport of sperm, and secretion of male sex hormones (androgens, mainly testosterone).



Components of Male Reproductive System:

Part	Location	Function
Testes	In scrotum	Sperm + Testosterone production
Epididymis	Attached to testes	Storage & maturation of sperm
Vas deferens	Extends to urethra	Transports sperm
Seminal vesicles	Posterior bladder	Secretes fructose-rich fluid for sperm nutrition
Prostate gland	Below bladder	Secretes alkaline fluid (neutralizes acidity)
Bulbourethral glands	Near urethra	Lubrication & mucus secretion
Penis	External organ	Copulation & urine/sperm passage

Mnemonic (to remember order of sperm pathway):

SEVEN UP

- **S**eminiferous tubules
- **E**pididymis
- **V**as deferens
- **E**jaculatory duct
- **N**othing
- **U**rethra
- **P**enis

Male Reproductive System Functions

Function	Organ Responsible
Sperm production	Testes (seminiferous tubules)
Sperm storage	Epididymis
Sperm transport	Vas deferens, ejaculatory duct
Nutritional fluid	Seminal vesicles
Alkaline secretion	Prostate gland
Lubrication	Bulbourethral glands

Nursing Booster Points

- **Primary function of testes**: Spermatogenesis + testosterone production.
- **Seminal vesicle secretion**: Rich in **fructose** → energy for sperm.
- **Prostate gland secretion**: **Alkaline** → protects sperm in acidic vagina.
- **Pathway mnemonic**: **SEVEN UP** (must-know for exams).
- **Scrotum** maintains temperature **2–3°C below body temperature** → essential for sperm survival.

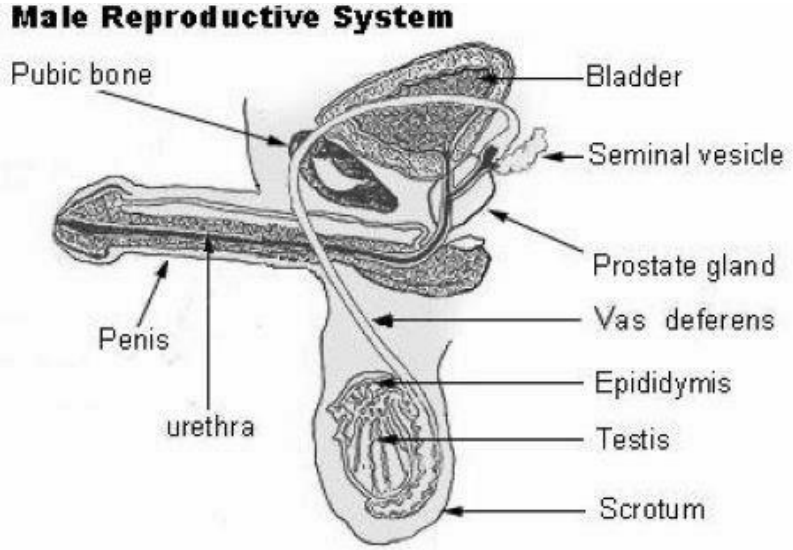
External Genitalia – Penis, Scrotum, Testes

The **external genitalia** in males are visible structures involved in **copulation, sperm delivery, and protection of testes**.

Components:

1. **Penis**
   - ✓ **Parts**: Root, Shaft, Glans penis.
   - ✓ **Urethra passes through** penis (urination + semen ejaculation).
   - ✓ Erectile tissues: **Corpus cavernosa (2)** + **Corpus spongiosum (1)**.
2. **Scrotum**
   - ✓ Pouch of skin containing **testes**.
   - ✓ Maintains **lower temperature (2–3°C below body temp)** for spermatogenesis.
   - ✓ Muscles: **Dartos (wrinkling)** & **Cremaster (elevates testes)**.
3. **Testes**
   - ✓ **Primary sex organs** (male gonads).
   - ✓ Enclosed by **tunica albuginea**.
   - ✓ Functional unit: **Seminiferous tubules** → spermatogenesis.
   - ✓ **Leydig cells** → secrete testosterone.
   - ✓ **Sertoli cells** → support sperm, secrete inhibin.

External Genitalia – Structure & Function

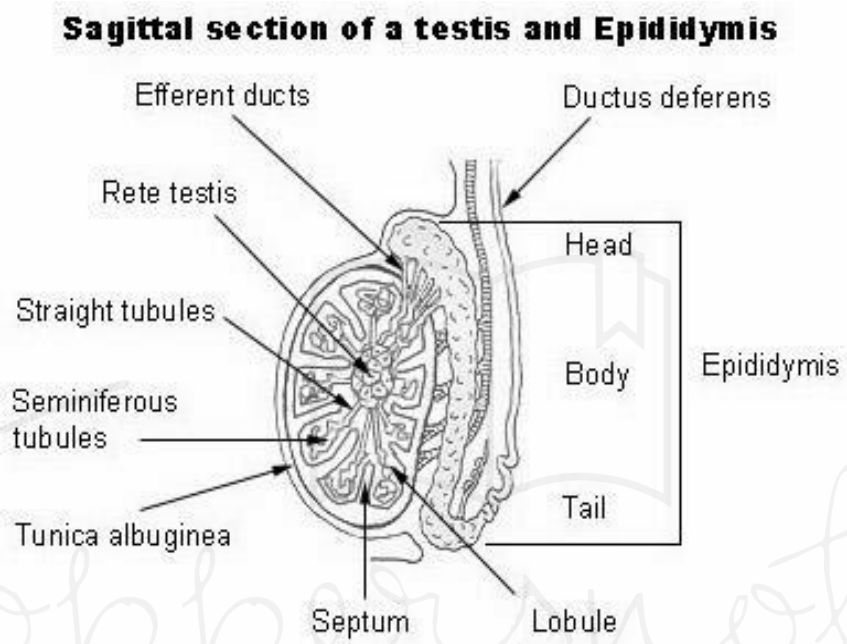


Structure	Location/Part	Function
Penis	Root, shaft, glans	Copulation, urine & semen passage
Scrotum	Pouch of skin below penis	Temperature regulation for testes
Testes	Inside scrotum, surrounded by tunica albuginea	Sperm + testosterone production

Mnemonics:

- **Testes Functions – "STI"**
  - ✓ **S**perm production (seminiferous tubules)
  - ✓ **T**estosterone secretion (Leydig cells)
  - ✓ **I**nhibin secretion (Sertoli cells)
- **Scrotum Muscle Mnemonic – "DC"**
  - ✓ **D**artos → wrinkles skin
  - ✓ **C**remaster → contracts & elevates testes

Testes Structure



Cell Type	Function
Sertoli	Support sperm, secrete inhibin, form blood-testis barrier
Leydig	Secrete testosterone
Spermatogonia	Germ cells → sperm formation

Nursing Booster Points

- **Primary male gonad = Testes**.
- **Erectile tissues**: 2 cavernosa + 1 spongiosum.
- **Leydig cells → testosterone** (secondary sex characters).
- **Sertoli cells → inhibin** (inhibits FSH).
- **Scrotum temp = 34–35°C**, vital for sperm survival.
- **Tunica albuginea** is fibrous covering of testes.

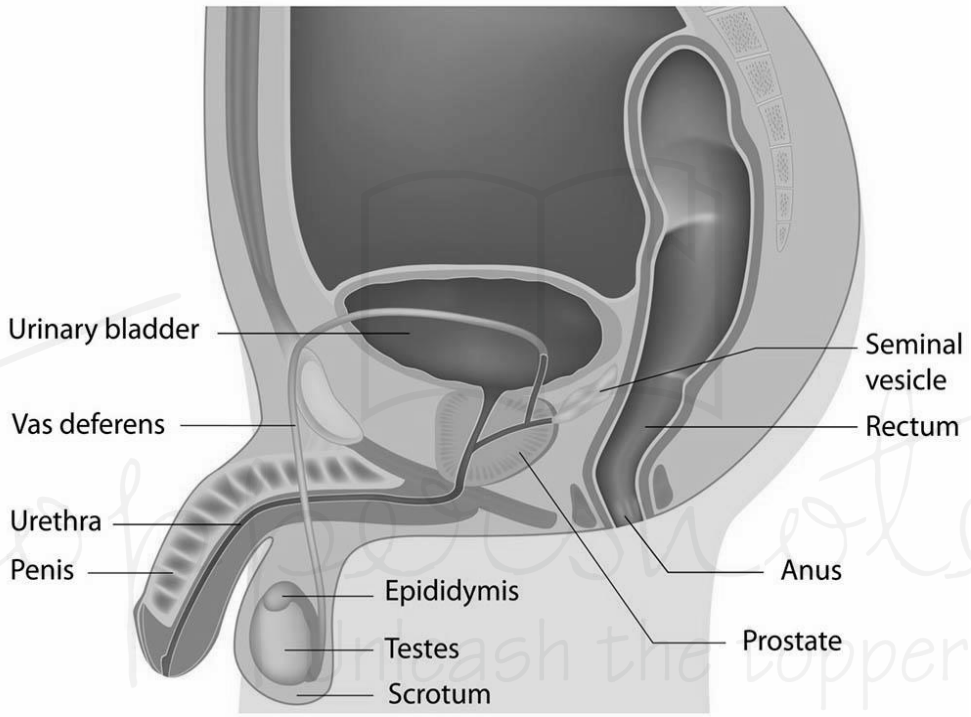
Internal Genital Organs – Epididymis, Vas Deferens, Seminal Vesicles, Prostate, Bulbourethral Glands

The **internal genital organs** in males are accessory structures that **store, transport, nourish, and protect sperm**.

1. **Epididymis**
   - ✓ Coiled tube on posterior testes.
   - ✓ **Function**: Storage & maturation of sperm.
   - ✓ Sperm gain **motility** here.

2. **Vas Deferens (Ductus Deferens)**
   - ✓ Muscular tube carrying sperm from epididymis → ejaculatory duct.
   - ✓ Part of **spermatic cord**.
3. **Seminal Vesicles**
   - ✓ Paired glands posterior to bladder.
   - ✓ Secrete **fructose-rich fluid** (energy for sperm).
   - ✓ Contribute **60% of semen volume**.
4. **Prostate Gland**
   - ✓ Walnut-sized gland below bladder, surrounds urethra.
   - ✓ Secretes **alkaline fluid** (neutralizes vaginal acidity).
   - ✓ Contributes **30% of semen volume**.
5. **Bulbourethral (Cowper's) Glands**
   - ✓ Small glands near urethra.
   - ✓ Secrete **mucus for lubrication**.

Internal Genital Organs & Functions



Organ	Function
Epididymis	Sperm storage, maturation, motility development
Vas deferens	Transport sperm to urethra
Seminal vesicles	Fructose secretion, 60% semen volume
Prostate gland	Alkaline secretion, 30% semen volume
Bulbourethral glands	Mucus lubrication

Mnemonics:

- **Accessory Glands Contribution – "S.P.B"**
  - ✓ **S**eminal vesicles – 60%
  - ✓ Prostate – 30%
  - ✓ Bulbourethral – <10%
- **Sperm Pathway Reminder = SEVEN UP**
  - ✓ **S**eminiferous tubules → **E**pididymis → **V**as deferens → **E**jaculatory duct → **N**othing → Urethra → **P**enis

Semen Composition

Component	Source	Function
Fructose	Seminal vesicle	Energy for sperm
Alkaline fluid	Prostate gland	Neutralizes vaginal acidity
Mucus	Bulbourethral glands	Lubrication
Spermatozoa	Testes	Fertilization

Nursing Booster Points

- **Longest duct = Vas deferens**.
- **Main storage = Epididymis**.
- **Major semen contributor = Seminal vesicles (60%)**.
- **Prostate secretion = alkaline** → MCQ favorite.
- **Bulbourethral glands = pre-ejaculatory lubrication**.
- **Sperm motility develops in epididymis**.

Male Reproductive Ducts & Urethra

The **male reproductive ducts** are channels that transport sperm from testes → exterior.

Pathway of Sperm (Reproductive Ducts):

1. **Seminiferous tubules** (sperm production)
2. **Epididymis** (storage & maturation)
3. **Vas deferens** (transport)
4. **Ejaculatory duct** (joins with seminal vesicle duct)
5. **Urethra** (final passage)

Male Reproductive Ducts

Duct	Function
Seminiferous tubules	Sperm formation
Epididymis	Sperm storage & maturation
Vas deferens	Sperm transport
Ejaculatory duct	Mixes sperm + secretions
Urethra	Common pathway for urine & semen

Mnemonic: SEVEN UP

- **S**eminiferous tubules
- **E**pididymis
- **V**as deferens
- **E**jaculatory duct
- **N** (nothing)
- **U**rethra
- **P**enis
  - ✓ **Common exam Q**: Longest duct = **Vas deferens**.
  - ✓ Urethra has **3 parts**: prostatic, membranous, penile.
  - ✓ Ejaculatory duct passes through **prostate gland**.

Blood Supply, Lymphatic Drainage & Nerve Supply

Blood Supply

Organ	Arterial Supply	Venous Drainage
Testes	Testicular artery (from abdominal aorta)	Pampiniform plexus → testicular vein
Penis	Internal pudendal artery	Deep dorsal vein
Prostate	Inferior vesical artery	Prostatic venous plexus

Lymphatic Drainage

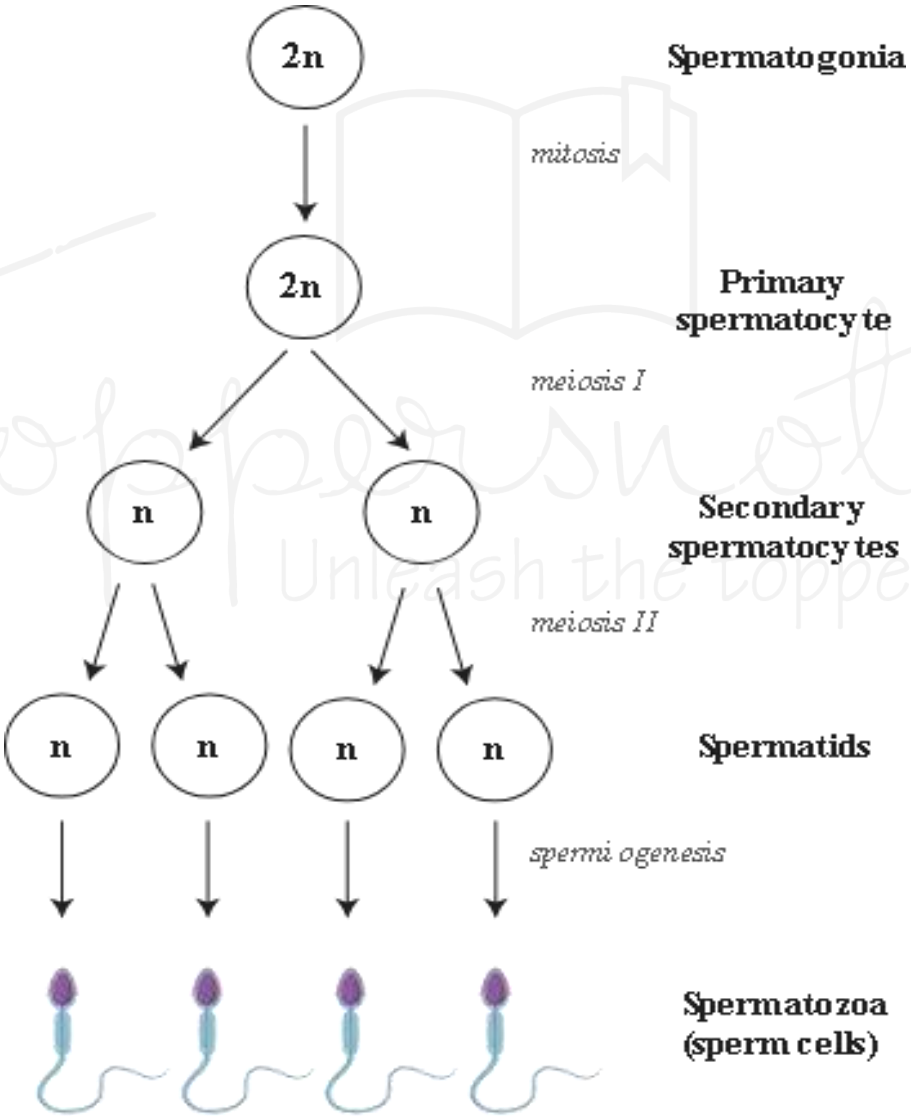
Organ	Lymph Drainage
Testes	Para-aortic (lumbar) nodes
Scrotum	Superficial inguinal nodes
Penis	Superficial & deep inguinal nodes
Prostate	Internal iliac nodes

Nerve Supply

Organ	Nerve Supply
Testes	Sympathetic nerves (T10–T11)
Penis	Pudendal nerve
Prostate	Pelvic splanchnic nerves

- **Testes drain to para-aortic nodes**, NOT inguinal (MCQ hotspot).
- **Scrotum drains to superficial inguinal nodes**.
- Penis innervation: **Pudendal nerve** (S2-S4).

Spermatogenesis



Spermatogenesis = Process of sperm formation from **spermatogonia → mature spermatozoa**. Occurs in **seminiferous tubules**.

Steps of Spermatogenesis

Stage	Cell	Description
1. Mitosis	Spermatogonia → primary spermatocytes	Cell multiplication
2. Meiosis I	Primary spermatocyte → secondary spermatocyte	Reduction division
3. Meiosis II	Secondary spermatocyte → spermatid	Haploid cells formed
4. Spermiogenesis	Spermatids → spermatozoa	Maturation & shaping

Mnemonic: "Go Play Some Soccer"

- **G**onia (spermatogonia)
- **P**rimary spermatocyte
- **S**econdary spermatocyte
- **S**permatid → spermatozoa

Time Duration:

- Total = **74 days**
- Sperms stored in **epididymis** for 2–3 weeks.
- Location: **Seminiferous tubules**.
- Controlled by: **FSH (stimulates Sertoli cells)** + **LH (stimulates Leydig cells → testosterone)**.
- **Spermatogenesis takes ~74 days**.
- **Sperm motility develops in epididymis**.

Hormonal Regulation (HPT Axis)

Male reproduction is controlled by the **Hypothalamic-Pituitary-Testicular (HPT) axis**.

Hormones & Functions

Hormone	Source	Function
GnRH	Hypothalamus	Stimulates pituitary
FSH	Anterior pituitary	Stimulates Sertoli cells → spermatogenesis
LH	Anterior pituitary	Stimulates Leydig cells → testosterone
Testosterone	Testes (Leydig cells)	Secondary sex characters, libido
Inhibin	Sertoli cells	Negative feedback on FSH

Mnemonic: "FLIT"

- **F**SH → Sertoli → spermatogenesis
- **L**H → Leydig → testosterone
- **I**nhibin → blocks FSH
- **T**estosterone → negative feedback
- **Leydig cells** → testosterone.
- **Sertoli cells → inhibin**.
- **GnRH → FSH + LH** release.
- Testosterone regulates **male secondary sex characteristics**

Semen – Composition, Functions & Clinical Relevance

Semen = mixture of sperm + secretions from accessory glands.

Composition of Semen

Component	Source	Function
Spermatozoa	Testes	Fertilization
Fructose	Seminal vesicles	Energy for sperm
Alkaline fluid	Prostate gland	Neutralizes vaginal acidity
Mucus	Bulbourethral glands	Lubrication
Enzymes	Prostate + seminal vesicles	Liquefaction of semen

- Normal semen volume: **2–5 ml**.
- Normal sperm count: **>15 million/ml**.
- pH: **7.2–8.0** (alkaline).

Mnemonic: "FAST M"

- Fructose – nutrition
- **A**lkali – neutralizes vagina
- **S**perm – fertilization
- **T**hick → liquefaction by enzymes
- **M**ucus – lubrication
- **Main energy source for sperm = Fructose** (seminal vesicle).
- **Liquefaction time** = 20–30 minutes.
- **pH alkaline** → protects sperm in acidic vagina.
- MCQ hotspot: **60% of semen = seminal vesicles, 30% prostate, <10% bulbourethral**.

Puberty & Male Secondary Sexual Characteristics

Puberty = developmental phase where reproductive capacity is achieved due to hormonal changes.

Onset:

- Normal male puberty: **9–14 years**.
- First sign: **testicular enlargement**.

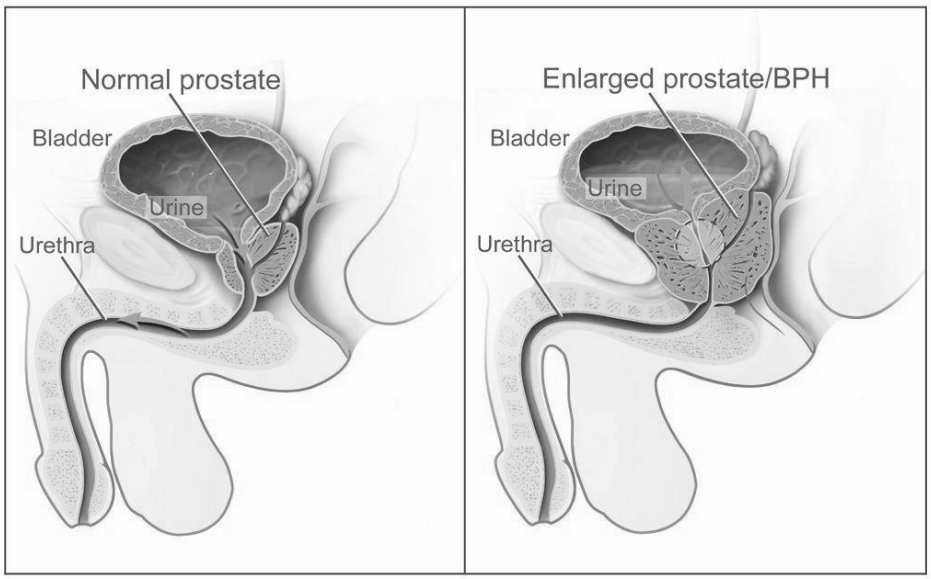
Male Secondary Sexual Characteristics

Feature	Hormone	Effect
Voice deepening	Testosterone	Laryngeal growth
Facial & body hair	Testosterone	Pubic, axillary, beard
Muscle mass increase	Testosterone	Anabolism
Penis & scrotum growth	Testosterone	Genital maturation
Spermatogenesis	FSH + LH	Fertility

Mnemonic: "V-HAMP"

- Voice deepening
- Hair growth
- Anabolism (muscles)
- Maturation of genitals
- Production of sperm
- **First sign of male puberty = testicular enlargement**.
- Testosterone is responsible for **libido + secondary sex characters**.
- Puberty is **earlier in girls** than boys.

Benign Prostatic Hyperplasia (BPH)



BPH = Non-cancerous enlargement of prostate gland, common in **men >50 years**.

Pathophysiology:

- Prostate enlarges → compresses urethra → obstructs urine flow.

Clinical Features:

- Hesitancy
- Weak urine stream
- Frequency, urgency, nocturia
- Incomplete emptying

Diagnosis & Treatment

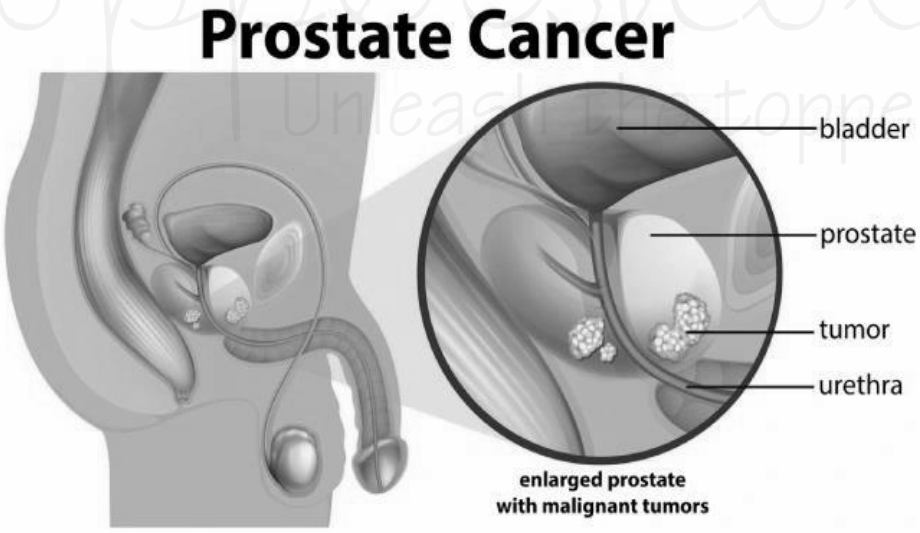
Investigation	**Finding**
Digital rectal exam	Enlarged, smooth prostate
PSA (Prostate-specific antigen)	Normal or slightly ↑
Ultrasound	Residual urine volume

Treatment	**Notes**
Alpha-blockers (Tamsulosin)	Relax smooth muscle
5-α reductase inhibitors (Finasteride)	Shrink prostate
TURP (Transurethral resection of prostate)	Surgical treatment

Mnemonic (Symptoms): "WISE"

- Weak stream
- Incomplete emptying
- Straining to void
- Enuresis/nocturia
- **Most common cause of urinary obstruction in elderly men** = BPH.
- **Prostate in BPH is smooth, non-tender** (vs. cancer = hard, nodular).
- Post-op TURP → monitor for **hematuria & continuous bladder irrigation**.

Prostate Cancer



Prostate cancer = Malignant tumor of prostate, usually **adenocarcinoma**.

Risk Factors:

- Age >60 years
- Family history
- High-fat diet
- African ethnicity

Clinical Features:

- Similar to BPH (hesitancy, weak stream, nocturia).
- Advanced: bone pain (spine metastasis), weight loss.

Diagnosis & Treatment

Test	Finding
Digital rectal exam	Hard, nodular prostate
PSA	Elevated
Biopsy	Confirmatory

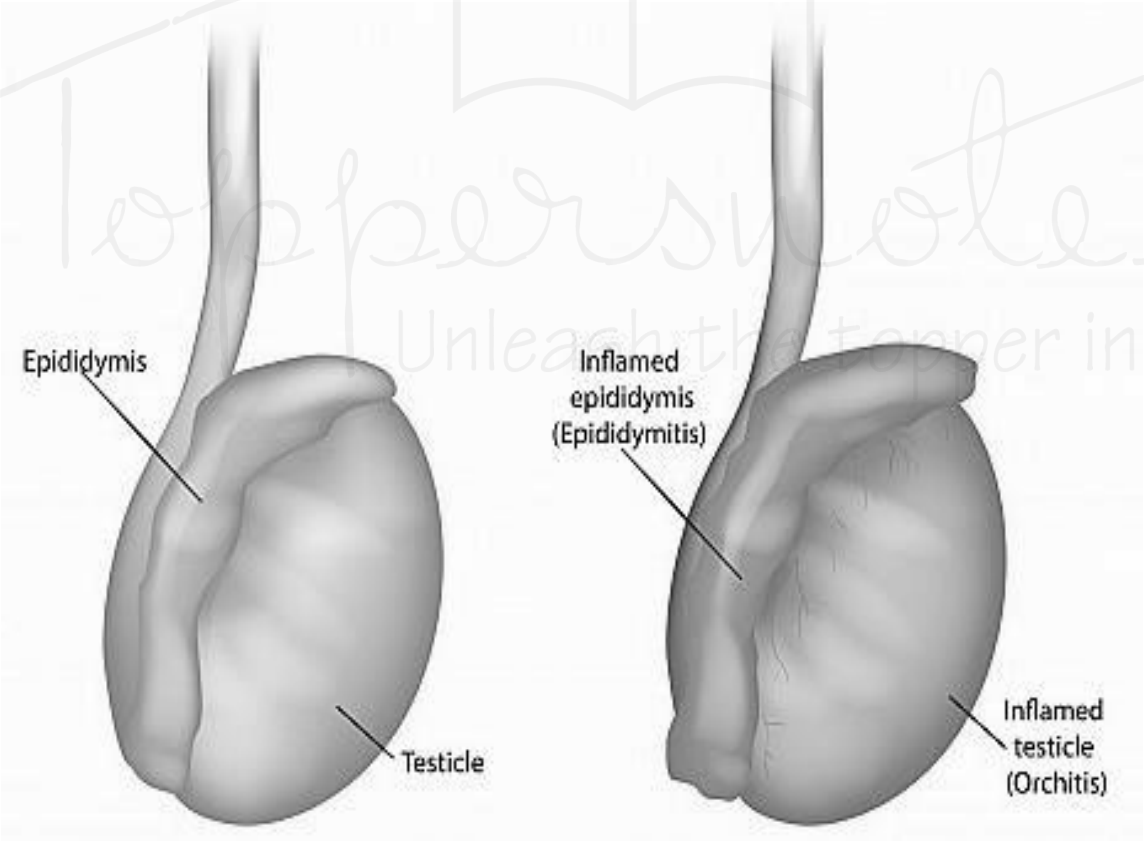
Treatment	Notes
Radical prostatectomy	Surgical removal
Hormonal therapy	Androgen deprivation (Leuprolide)
Radiation therapy	For localized disease

Mnemonic: "CAP"

- **C**ancer = Calcified, hard prostate
- Age >60
- PSA ↑
- **Prostate cancer = hard, nodular prostate** (vs. BPH = smooth).
- **Metastasis to bones → back pain** (MCQ).
- **PSA test used for screening**.

Orchitis, Epididymitis & Hydrocele

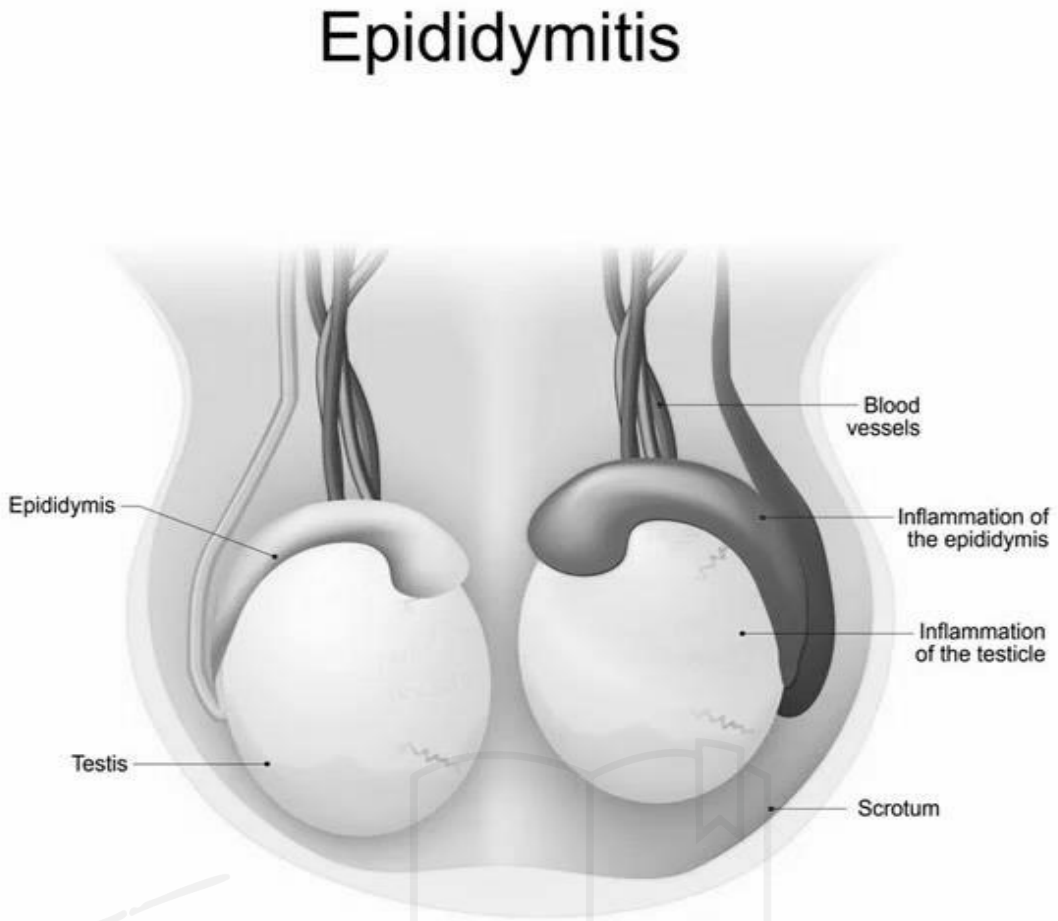
Orchitis



Inflammation of the testes.

- Causes: **Mumps virus (post-puberty)**, bacterial infections, trauma.
- Symptoms: Swollen, tender testis, fever, pain.
- Complication: Infertility (due to testicular atrophy).

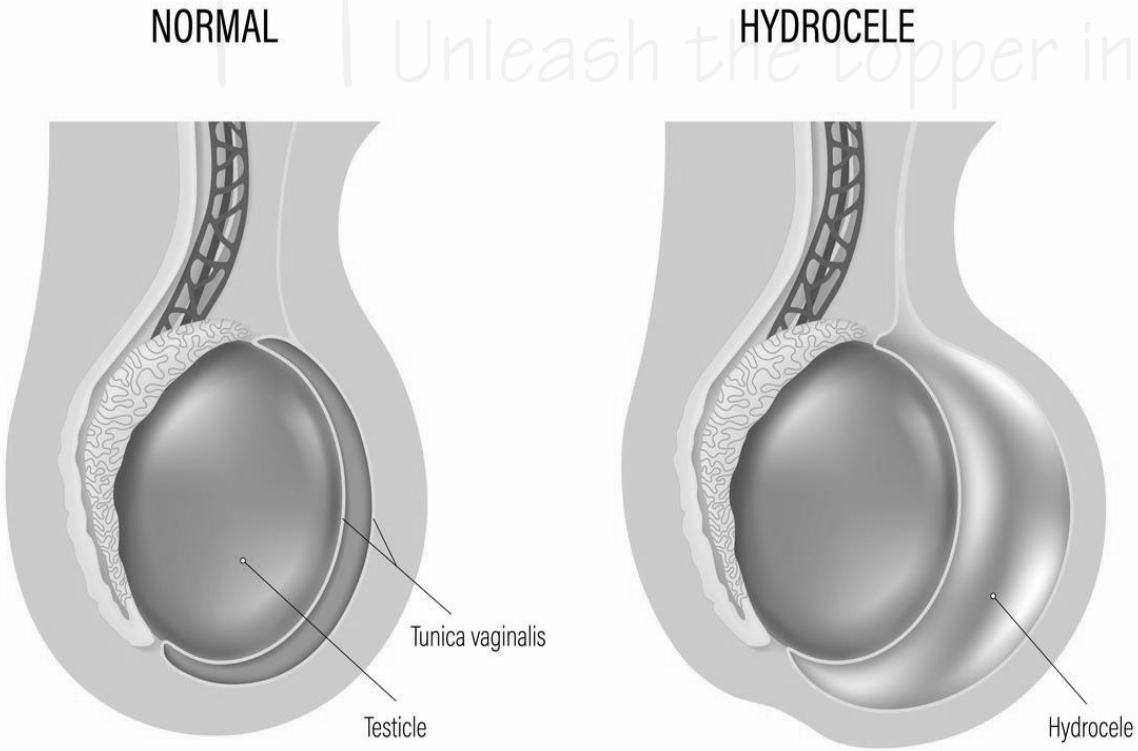
Epididymitis



Inflammation of epididymis.

- Causes: **STIs (Chlamydia, Gonorrhea)**, urinary infections.
- Symptoms: Painful scrotal swelling, fever, dysuria.
- Diagnosis: Urine culture, Doppler US.

Hydrocele



Toppersnotes
Unleash the topper in you

Collection of fluid around the testis.

- Types:
  - ✓ **Congenital** (patent processus vaginalis).
  - ✓ **Acquired** (infection, trauma).
- Symptoms: Painless scrotal swelling, transillumination positive.
- Treatment: Aspiration, hydrocelectomy.

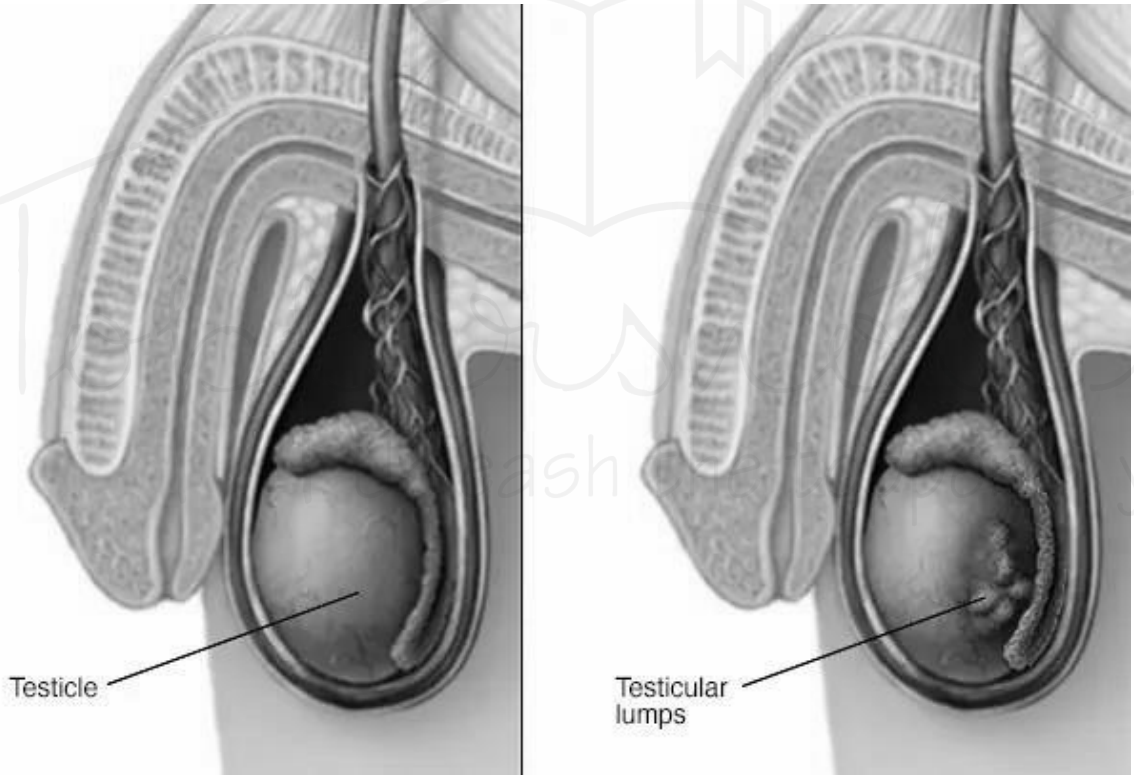
Comparison

Condition	Cause	Key Feature
Orchitis	Viral (mumps), bacterial	Painful, tender testes
Epididymitis	STI/UTI	Pain, fever, dysuria
Hydrocele	Fluid collection	Painless swelling, transillumination +

Mnemonic: "OEH" – Orchitis, Epididymitis, Hydrocele

- **O**rchitis = **O**uch (painful infection).
- **E**pididymitis = **E**ntry of infection from urethra.
- **H**ydrocele = **H**20 (fluid).
- **Hydrocele transilluminates light**, tumor does not.
- **Mumps orchitis → infertility**.
- **STI-related epididymitis → treat both patient & partner**.

Testicular Cancer



Malignant tumor of testis, common in men 15–35 years.

Risk Factors:

- Cryptorchidism (undescended testes).
- Family history.
- Infertility.

Clinical Features:

- Painless, hard lump in testis.
- Testicular enlargement.
- Does **not transilluminate** (differentiates from hydrocele).

Diagnosis:
- Tumor markers: **AFP, β-hCG, LDH**.
- Ultrasound.
- Biopsy avoided → risk of spread.

Treatment:
- **Orchiectomy (surgical removal)**.
- Chemotherapy, radiotherapy (depending on type).

Mnemonic: "ABC" – Tumor markers
- **A**FP
- **B**eta-hCG
- **C**hemotherapy follow-up
- **Most common cancer in young men (15–35 yrs)**.
- **Painless hard lump = testicular cancer**.
- **Hydrocele vs tumor** → hydrocele transilluminates, tumor does not.

Erectile Dysfunction & Infertility

Erectile Dysfunction (ED)

Inability to achieve/maintain erection.
- Causes:
  - ✓ Vascular (diabetes, hypertension).
  - ✓ Neurogenic (spinal cord injury).
  - ✓ Psychological (stress, anxiety).
  - ✓ Drugs (antihypertensives, alcohol).
- Treatment:
  - ✓ **Sildenafil (Viagra)** → PDE-5 inhibitor.
  - ✓ Counseling, vacuum devices.

Male Infertility

Inability to conceive after **1 year of unprotected intercourse**.
- Causes:
  - ✓ Low sperm count (**oligospermia**).
  - ✓ No sperm (**azoospermia**).
  - ✓ Poor motility (**asthenospermia**).
  - ✓ Infections, hormonal imbalance, varicocele.
- Diagnosis:
  - ✓ **Semen analysis** (volume, count, motility, morphology).
  - ✓ Hormonal assays (FSH, LH, testosterone).
- Treatment:
  - ✓ Correct underlying cause.
  - ✓ Assisted reproduction (IVF, ICSI).

Causes of Infertility

Category	Examples
Pre-testicular	Hormonal imbalance (low FSH/LH)
Testicular	Varicocele, orchitis, trauma
Post-testicular	Obstruction in vas deferens/ejaculatory duct

Mnemonic: "FIND" – Causes of ED
- **F**ailure of blood flow
- **I**njury to nerves
- **N**euro/psychological causes
- **D**rugs

- **First-line test for infertility = semen analysis**.
- **Normal sperm count >15 million/ml**.
- **Drug of choice in ED = Sildenafil (PDE-5 inhibitor)**.

Sexually Transmitted Infections (STIs) in Males

Common STIs & Features

Infection	Causative Agent	Symptoms
Syphilis	Treponema pallidum	Painless chancre (primary), rash (secondary)
Gonorrhea	Neisseria gonorrhoeae	Urethral discharge, dysuria
Chlamydia	Chlamydia trachomatis	Watery discharge, painful urination
HIV/AIDS	HIV virus	Immunosuppression, opportunistic infections
Genital warts	HPV	Warty growths
Genital herpes	HSV-2	Painful vesicles, ulcers

Mnemonics:

- **Syphilis progression – "PSS"**
  - ✓ **P**rimary = Painless chancre
  - ✓ **S**econdary = Skin rash
  - ✓ **S**econdary late = Systemic damage (neuro, cardio)
- **Gonorrhea = G for Green discharge**
- **Syphilis painless, herpes painful**.
- **Gonorrhea discharge = thick, purulent**.
- **Chlamydia discharge = thin, watery**.
- **HIV confirmatory test = Western blot / ELISA**.
- **HPV causes genital warts & cervical cancer risk in females**.

Nursing Assessment in Male Reproductive Disorders

Assessment Framework (Nursing Process)

Aspect	Key Points
History	Urinary symptoms (frequency, hesitancy, nocturia), pain, sexual history, fertility issues
Inspection	Scrotal swelling, penile lesions, discharge
Palpation	Testicular lumps, prostate (via rectal exam)
Investigations	PSA, semen analysis, ultrasound, biopsy

Let the topper in you

- Always **ask about urinary symptoms in elderly men** → think BPH or prostate cancer.
- **Painless testicular lump = cancer**, **painful swelling = infection**.

Nursing Interventions & Patient Education

General Nursing Interventions

- Monitor urinary output (for BPH, post-TURP).
- Pain management.
- Infection prevention (catheter care).
- Psychological support (infertility, cancer, ED).

Patient Education

- Encourage testicular self-exam (monthly, after warm shower).
- Reduce STI risk → condom use, safe sex practices.
- Lifestyle: low-fat diet, quit smoking, regular exercise.
- Medication adherence (alpha-blockers, hormonal therapy).
- **TURP patients → continuous bladder irrigation (CBI)** to prevent clot retention.
- **Post-prostatectomy → monitor for urinary incontinence & impotence**.

Diagnostic Procedures

Common Diagnostic Tests

Test	Purpose
PSA (Prostate Specific Antigen)	Elevated in prostate cancer, BPH
Digital Rectal Exam (DRE)	Prostate assessment (smooth in BPH, hard in cancer)
Semen analysis	Infertility evaluation (count, motility, morphology)
Ultrasound (scrotal, TRUS)	Detect lumps, hydrocele, prostate size
Biopsy	Confirm malignancy
Tumor markers (AFP, β-hCG, LDH)	Testicular cancer

- **PSA >4 ng/ml suspicious**.
- **BPH = smooth enlarged prostate**, **Cancer = hard nodular prostate**.
- **Semen analysis = first-line test in male infertility**.
- **Sperm pathway = SEVEN UP**.
- **Testes functions = STI** (Sperm, Testosterone, Inhibin).
- **BPH symptoms = WISE** (Weak stream, Incomplete emptying, Straining, Enuresis).
- **Causes of ED = FIND** (Failure of blood flow, Injury, Neuro/Psych, Drugs).
- **Testicular tumor markers = ABC** (AFP, Beta-hCG, Chemo follow-up).
- First sign of male puberty → **testicular enlargement**.
- Main energy source of sperm → **fructose**.
- Temperature required for spermatogenesis → **2–3°C below body temp**.
- Painless testicular lump → **cancer**.
- Hard nodular prostate → **cancer**; Smooth enlarged prostate → **BPH**.
- Hydrocele vs tumor → Hydrocele **transilluminates**, tumor does not.

Topic	Typical Question
Pathway of sperm	Mnemonic SEVEN UP
Testicular cells	Leydig → Testosterone, Sertoli → Inhibin
BPH vs Prostate Cancer	Smooth vs hard prostate
Hydrocele vs Tumor	Transillumination
Puberty	First sign = testicular enlargement
Testicular cancer	Painless hard lump, tumor markers
ED treatment	Sildenafil (PDE-5 inhibitor)
Semen composition	Seminal vesicles 60%, prostate 30%
Lymph drainage	Testis → para-aortic nodes, scrotum → superficial inguinal
TURP care	Continuous bladder irrigation

2 CHAPTER Oncology

Introduction to Oncology

- **Oncology** → Branch of medical science dealing with **neoplasms (tumors)**.
- **Neoplasia** → Process of new, abnormal tissue growth.
- **Neoplasm (Tumor)** →
  - ✓ Abnormal mass of tissue.
  - ✓ Growth **exceeds** & is **uncoordinated** with normal tissue.
  - ✓ Persists even after removal of stimulus.

Types of Tumors

Feature	Benign Tumor	Malignant Tumor
Nature	Innocent, non-cancerous	Harmful, cancerous
Growth	Slow, localized	Rapid, invasive
Capsule	Well capsulated	Non-capsulated
Differentiation	Cells resemble normal tissue	Poor/absent differentiation
Metastasis	Absent	Present
Recurrence	Rare	Common
Prognosis	Good	Poor if untreated

Cancer word derived from **Greek "Karkinos = Crab"** → spreads in all directions like crab movement.

Cell Growth & Cell Cycle

Cell cycle = **sequence of growth & division of a cell**

Phases of Cell Cycle

Phase	Description
M Phase (Mitosis)	Cell division → 10% of cycle
Interphase	Cell prepares for division → 90% of cycle
G0	Resting phase (non-dividing)
G1	Gap 1 → RNA & protein synthesis, cell growth
S Phase	DNA replication (Synthesis)
G2	Gap 2 → Protein synthesis, energy storage, preparation for mitosis

- **M Phase** = Active division (shortest phase).
- **Interphase** = Longest phase (where cancer cells often lose control).

General Features of Cancer Cells

- Uncontrolled growth
- Loss of differentiation (Anaplasia)
- Ability to invade & metastasize
- Altered cell surface antigens
- ↑ Nucleus-to-cytoplasm ratio
- Resistance to apoptosis

Mnemonic: "CANCER"

- **C** – Continuous growth

- **A** – Anaplasia (loss of differentiation)
- **N** – New antigens (abnormal cell markers)
- **C** – Cell invasion & metastasis
- **E** – Enlarged nucleus (high N:C ratio)
- **R** – Resistance to apoptosis

Cancer & Tumours

Cancer

- A condition where cells show **loss of control in cell cycle**.
- In cancer:
  - ✓ **90% time → M-phase** (mitosis, abnormal rapid division)
  - ✓ **10% time → Interphase** (resting phase, minimal control)

Types of Malignant Tumours

Tumour Type	Origin	Examples	Danger Level
Carcinoma	Epithelial cells	Skin, lung, stomach, colon	Less dangerous
Sarcoma	Connective/mesenchymal tissue (muscle, bone, cartilage)	Osteosarcoma, Rhabdomyosarcoma	**More dangerous**

Mnemonic: *"Car – Cover (epithelium), Sar – Support (connective tissue)"*

Cell Adaptations

Term	Definition
Hypertrophy	↑ Size of cells (after development)
Hyperplasia	↑ Number of normal arranged cells
Atrophy	↓ Size of cells (after development)
Metaplasia	Change of one adult tissue → another
Dysplasia	Abnormal tissue growth; loss of cell regularity, variability in size/shape

Dysplasia Stages

- **Mild Dysplasia** → Early changes
- **Moderate Dysplasia** → Progressing abnormality
- **Severe Dysplasia / Carcinoma in situ** → Malignant cells **confined within basement membrane**
  Carcinoma in situ = Pre-cancerous, curable stage
- Cytological features of malignancy but **no invasion**
- If untreated → progresses to invasive cancer

Examples:

- Leukoplakia (white oral patches)
- Chronic gastritis
- Chronic smoking (colon, lung)

Iodine Staining Test

- **Normal squamous epithelium of vagina & cervix**:
  - ✓ Contains **glycogen** → stains **brown with iodine**
- **Cancer cells**:
  - ✓ No glycogen → **do not stain with iodine**

  Clinical tool for **precancerous detection**.

Invasion

- **Definition**: Spread of malignant cells into surrounding tissue.

- **Benign Tumour** → Encapsulated, no invasion
- **Malignant Tumour** → Non-capsulated, infiltrates tissues

Special Features of Malignant Cells
- Have **30% less Ca^{2+}** than normal → poor adhesiveness → easy detachment → invasion/metastasis
- **Invasion = hallmark of malignancy**

Hypocalcemia in Cancer
Seen in:
- Breast Cancer
- Bone Cancer
- Multiple Myeloma
- Parathyroid Cancer

Nursing Booster Points
- Carcinoma → epithelial origin
- Sarcoma → connective tissue, more dangerous
- Carcinoma in situ → pre-cancer, curable stage
- Malignant = invasion + low calcium + metastasis
- Benign = encapsulated, no invasion
- Iodine test → Normal = brown, Cancer = no stain

Risk Factors of Cancer (Carcinogens)
1. Endogenous (Non-modifiable)
- **Genetic/Hereditary**
- **Age**:
  - ✓ Prostate cancer common in **>40–45 yrs males**
  - ✓ Breast cancer risk ↑ with age
- **Race**: Some cancers more in specific ethnic groups
- **Sex/Hormones**:
  - ✓ Estrogen → Breast cancer in females
  - ✓ Testosterone → Prostate & Esophageal cancers in males

2. Exogenous Carcinogens
A) Physical
- Heat: *Kangri Cancer* (Abdominal skin cancer in Kashmiri people)
- Chronic irritation/trauma: Oral cancer in tobacco chewers
- Smoking: Lung, oral cancers

B) Radiation
- UV rays: Skin cancer
- X-rays / Radioactive exposure: DNA damage → mutations

C) Biological Agents
- **Bacteria**: *Helicobacter pylori* → Gastric cancer
- **Parasite**: *Schistosoma haematobium* → Bladder cancer
- **Fungi**: *Aspergillus flavus (Aflatoxin B1)* → Liver cancer
- **Viruses**:
  - ✓ HBV / HCV / HDV → Liver cancer
  - ✓ EBV (Epstein-Barr virus) → Lymphoma (esp. Burkitt's)
  - ✓ HPV → Cervical cancer
  - ✓ CMV (in AIDS) → Kaposi's sarcoma