Male Reproductive System

Slides in bold, book in green (don't let the number of pages intimidate you—it's mostly pictures and it's a pretty easy lecture)

The reproductive system in men has components in the abdomen, pelvis, and perineum. The major components are:

• External genitalia:
  – penis, scrotum (testis, epididymis, ductus deference), & spermatic cord
• Internal genitalia:
  – Seminal vesicles, ductus deference, ejaculatory duct, prostate & bulbourethral glands

**Penis**

• Parts: Root & Body
• Root function to fix the penis to the pelvis and which consists of
  1→ Bulb of the penis: which is the proximal part of the corpus spongiosum (will get to this in a minute) anchored to the perineal membrane.
• Attached in the midline to urogenital diaphragm
• Traversed by urethra
• Covered by the bulbospongiosus m.

2→ Right & left crura of the penis
• Attached to the pubic arch
• Covered by the ischiocavernosus m.

- Body → which is covered entirely by skin, consist of:
  → Corpus spongiosum – ventrally (inferiorly)
  • Continuation of the bulb
  • Contains the urethra
  • Ends with glans penis
    - Corona & neck of glans → The base of the glans is expanded to form a raised circular margin (the corona of the glans) and the depression posterior to the corona is the neck of the glans.
    - External urethral meatus: sagittal slit, normally positioned at the tip of the glans.
  → Corpora cavernosa (paired) – dorsally: sinuses that will fill with blood during erection, in spongiosum there will be less sinuses in order to protect the urethra from collapsing.
  • Continuation of the penile crura
  • Covered distally by the glans
    - Prepuce (foreskin): fold of skin covers the glans. Normally, a fold of skin at the neck of the glans which is continuous anteriorly with skin of glans and posteriorly with the skin of the body and extends forward to cover the glans. The prepuce is removed during male circumcision, leaving the glans exposed
• **Frenulum**: median fold of skin that attaches the glans to skin proximal to the glans.

Because the anatomical position of the penis is erect, the paired corpora are defined as dorsal in the body of the penis and the single corpus spongiosum as ventral, even though the positions are reversed in the nonerect (flaccid) penis.

- **Fascia**: because the penis is part of the superficial perineal pouch so the fascia is a continuation of the fascia of the abdomen
  - **Superficial fascia**
  - **Continuous with that of the scrotum (dartos fascia)**
  - **Deep fascia (Buck's fascia): a tubular sheath of fascia**
- **Covers the erectile columns** → separate different parts of the body of penis from each other.

The fixation of the penis is dependent on 1-root (bulb & crura)

2- **Ligaments**
- **Suspensory ligament of penis** (middle)
- **From pubic symphysis to deep fascia**
- **At junction between root & body**
- **Fundiform ligament of penis** (on the sides & more superficially)
- **From linea alba to the superficial fascia**
• **Blood supply:**

**branches of the internal pudendal a.** (br from internal iliac a.) enter from the lesser sciatic foramen & traverse the anal canal to urogenital triangle:

⇒ Deep aa. of the penis – supply corpora cavernosa
⇒ Artery of the bulb – supply corpus spongiosum
⇒ Dorsal artery of the penis – supply superficial parts of the penis

• **Lymphatics:**
  – Skin – superficial inguinal nodes
  – Deep structures – internal iliac nodes
• Nerve supply:
  – Dorsal nerve of the penis – pudendal n. (sensory mostly)
  – Parasympathetic – inferior hypogastric plexus (control the filing of the sinuses during erection)
**Scrotum**

- Out pouching of the lower anterior abdominal wall
- **Layers**
  - **Outside** – Skin
    - Superficial fascia
      - Dartos m. (replace the fatty layer)
      - Colles’ fascia (continuation of Scarpa’s fascia → membranous part of abdominal fascia)
    - Septum of scrotum separate the scrotum into 2 parts
    - External spermatic fascia (continuation of ext. oblique m.)
    - Cremasteric fascia (continuation of int. oblique m.)
    - Internal spermatic fascia (continuation of fascia transversalis)
    - Tunica vaginalis (continuation of peritoneum)
  - **Inside**
    - Ease the movement of teste

Scrotum is the male homologue of the labia majora

• **Blood Supply:**
  - Anterior scrotal -external pudendal br of femoral a.
  - Posterior scrotal - scrotal branches of internal pudendal aa.

• **Lymphatics:**
  - Superficial inguinal nodes

• **Nerve supply:**
  - Anterior scrotal – ilioinguinal n. & genital branch of the genitofemoral n. (lumber plexuses).
– Posterior scrotal – branches of the perineal n. & posterior cutaneous nerves of the thigh (sacral plexuses).

**Spermatic Cord**

form at the deep inguinal ring and consists of structures passing between the abdominopelvic cavities and the testis.

*Coverings:*
- External spermatic fascia
  – Ext. oblique aponeurosis
- Cremasteric fascia
  – Int. oblique m.
- Internal spermatic fascia
  – Transversalis fascia

**Content**
- The vas deferens → returns sperms towards abdomen
- The testicular artery - aorta
- Testicular vein (from pampiniform plexus surrounding other structure within the cord) – to IVC & left renal v.
- Testicular lymph vessels
  – Follow the artery
• Autonomic nerves
  – Sympathetic – follow the artery
• Remnants of processus vaginalis – peritoneum (tunica vaginalis in men forms as an extension of the developing peritoneal cavity that becomes separated off during development.)
• Genital branch of the genitofemoral nerve
  – innervations to the cremasteric muscle

Testes
• Paired oval glands measuring 2 in. by 1 in.
  – Left usually at a lower level
• Surrounded by dense white capsule called tunica albuginea
  – septa form 200 - 300 compartments called lobules
  – Mediastinum - posteriorly
• Each is filled with 2 or 3 seminiferous tubules where sperm are formed
Pathway of Sperm Flow through the Ducts of the Testis
• Seminiferous tubules → Straight tubules → Rete testis → Efferent ducts → Ductus epididymis → Ductus (vas) deferens

Temperature Regulation of Testes
• Sperm survival requires 3 degrees lower temperature than core body temperature
• Mechanisms of regulating temperature
  – Dartos muscle causes wrinkling of scrotal wall
  – Cremaster muscle in spermatic cord
    • Elevates testes on exposure to cold & during arousal
    • Warms reverses the process
  – Countercurrent heat exchange
    • Pampiniform plexus & the branches of the testicular aa → the plexus surround the artery so it cools the blood in it.

*If testes were inside the abdomen the sperm will be unfunctional.

Descent of Testes
• Develop near kidney on posterior abdominal wall
• Descends into scrotum by passing through inguinal canal
  – during 7th month of fetal development
• Drag with it the blood, nerve & lymphatic supply
Sometime surgical intervention is needed when the testes are not fully descended at birth.
Epididymis

- Comma-shaped organ, 1.5in long along posterior border of each testis
- Ductus epididymis - 20 feet tube if uncoiled → storage & complete maturation of sperms
  - Head
    - Receive multiple efferent ducts containing sperms
  - Body
  - Tail
    - Continues as ductus deferens on the medial side of epididymis
  - Sinus of the epididymis
    - Laterally between epididymis & testis

- Site of sperm maturation
  - Motility increases over 2 week period
- Storage for 1-2 months
- Absorbs excess fluid
- Add nutrient substances
- Propels sperm onward
**Testes & Epididymis**

- **Blood Supply:**
  - Testicular a. – aorta
  - Left testicular v. – left renal v.
  - Right testicular v. – IVC
- **Lymphatics:**
  - Lumbar lymph nodes
- **Nerve supply:**
  - Testicular plexus
    - Parasympathetic – vagus
    - Sympathetic – T7 (cuz they develop high on the posterior abdominal wall and then descend)

**Ductus (Vas) Deferens**

- **Pathway of 18 inch muscular tube** that transport sperms from epididymis to the urethra
  - ascends along medial side of epididymis
  - passes up through spermatic cord and inguinal ligament
  - reaches posterior surface of urinary bladder
  - empties into prostatic urethra with seminal vesicle
- **Lined with pseudostratified columnar epithelium & covered with heavy coating of muscle**
  - convey sperm along through peristaltic contractions
  - stored sperm remain viable for several months
- **Blood supply:** according to its location
  - In the scrotum → testicular a.
  - Later on → Branches from the vesicle arteries
  - Veins drain into the testicular or prostatic veins

Ductus (Vas) Deferens

- Traverse deep inguinal ring

- Cross inferior epigastric artery laterally

- Run on the pelvic floor backward and inferiorly
• Cross the ureters medially

• End with the ampulla medial to seminal vesicle & posterior to urinary bladder

→ Semen is composed of sperms & secretion from glands ( seminal vesicles & prostate gland ) so semen finally accumulate in prostatic urethra

**Seminal Vesicles**

• Pair of pouch-like organs found posterior to the base of bladder with a duct that will fuse with the vasa deferens forming ejaculatory duct which will penetrate the post part of the prostate so semen flow into prostatic urethra with the duct of the prostate.

• **Anterior to rectum**

  The tube is coiled with numerous pocket-like outgrowths and is encapsulated by connective tissue
  
  – Rectovesical pouch
  
  – Alkaline, viscous fluid
  
  – neutralizes acidity of vagina & male urethra
  
  – fructose for ATP production
  
  – prostaglandins stimulate sperm motility & viability
  
  – clotting proteins for coagulation of semen

• **Blood supply:**
  
  – Inferior vesicle & middle rectal vessels

• **Lymphatics:** internal iliac nodes
**Ejaculatory Ducts**

- Formed from duct of seminal vesicle & ampulla of vas deferens
- About 1 inch long
- Adds fluid to prostatic urethra just before ejaculation
- Pierces prostate posteriorly and drain beside the utricle
**Prostate Gland**

- Conical shape gland
  - **Base** – above towards the neck of bladder
  - **Apex** – below in relation with urogenital diaphragm

It lies immediately inferior to the bladder, posterior to the pubic symphysis, and anterior to the rectum

- Surrounds the prostatic urethra
  - Urethral crest
    - **Prostatic utricle** – analog of uterus & vagina
  - **Prostatic sinus**

- Covered by fibrous capsule
- **Fascial sheath covers the capsule** (the visceral layer of the pelvic fascia)

Between these 2 layers lies the BV especially the veins which drains the bladder as well.

- Ligaments – connected to the fascial sheath
  - **Anteriorly** – puboprostatic ligament
  - **Posterioly** – rectovesical septum (fascia of Denonvill)

**Relations**

- Superiorly – urinary bladder neck
- Inferiorly – urogenital diaphragm
- Laterally levator ani muscles
- Anteriorly – pubic symphysis
- Retropubic space (cave of Retzius)
- Extraperitoneal fat
Posteriorly – rectal ampulla

Prostate contribute to the fixation of the bladder with the surrounding structure so the vital structure entering the bladder will enter through the fascia of the prostate like BV & nerves.

Structure:
• Lobes
  → Anterior (isthmus) – anterior to urethra
    • Musculofibrous - No glands
  → Posterior – posterior to urethra
  → Median (middle) – between urethra & ejaculatory duct
  → Right & left lateral – sides of urethra
• Zones – Central zone – drain directly into urethra
  – Transitional zone – drains into the sinus
  – Peripheral zone – drains into the sinus
• Blood supply:
  – Branches from the inferior vesicle & middle rectal aa.
  – Prostatic venous plexus – between capsule and fascial sheath
• Drains into internal iliac v.
• Lymphatics: internal iliac nodes
• Nerve supply: hypogastric plexus

**Bulbourethral or Cowper’s Gland**
• Paired, pea-sized gland within the UG diaphragm
• Ducts pierce the perineal membrane
  – Opens into spongy Urethra(lateral wall)
• Secretes alkaline mucous that neutralizes acids and lubricates
  *do not contribute to the semen

**Semen**
• Mixture of sperm & seminal fluid
  – glandular secretions and fluid of seminiferous tubules
  – slightly alkaline, milky appearance, sticky
  – contains nutrients, clotting proteins & antibiotic seminal plasmin
• Typical ejaculate is 2.5 to 5 ml in volume
• Normal sperm count is 50 to 150 million/ml
  – actions of many are needed for one to enter
• Coagulates within 5 minutes -- reliquefies in 15 due to
enzymes produced by the prostate gland
• Semen analysis—bad news if show lack of forward motility, low count or abnormal shapes

**Erection & Ejaculation**
• Erection
  – sexual stimulation dilates the arteries supplying the penis
  – blood enters the penis compressing the veins so that the blood is trapped.
  – parasympathetic reflex causes erection
• Ejaculation
  – muscle contractions close sphincter at base of bladder and move fluids through ductus deferens, seminal vesicles, & ejaculatory ducts
  – ischiocavernousus & bulbospongiosus complete the job