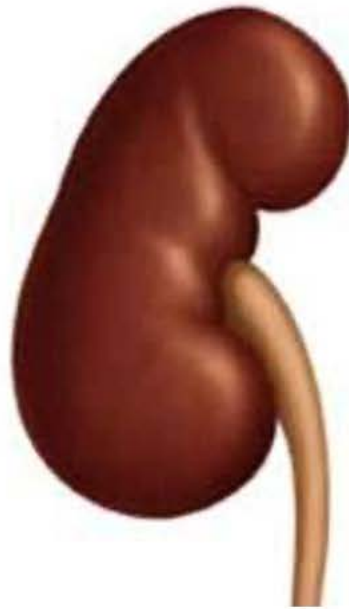


# Anatomy of The Genitourinary System



**Farshad Gholipour**  
Assistant Professor of Urology



The kidneys are large, bean-shaped, glandular organs located bilaterally in the retroperitoneal space of the thoracolumbar region behind the abdominal cavity.

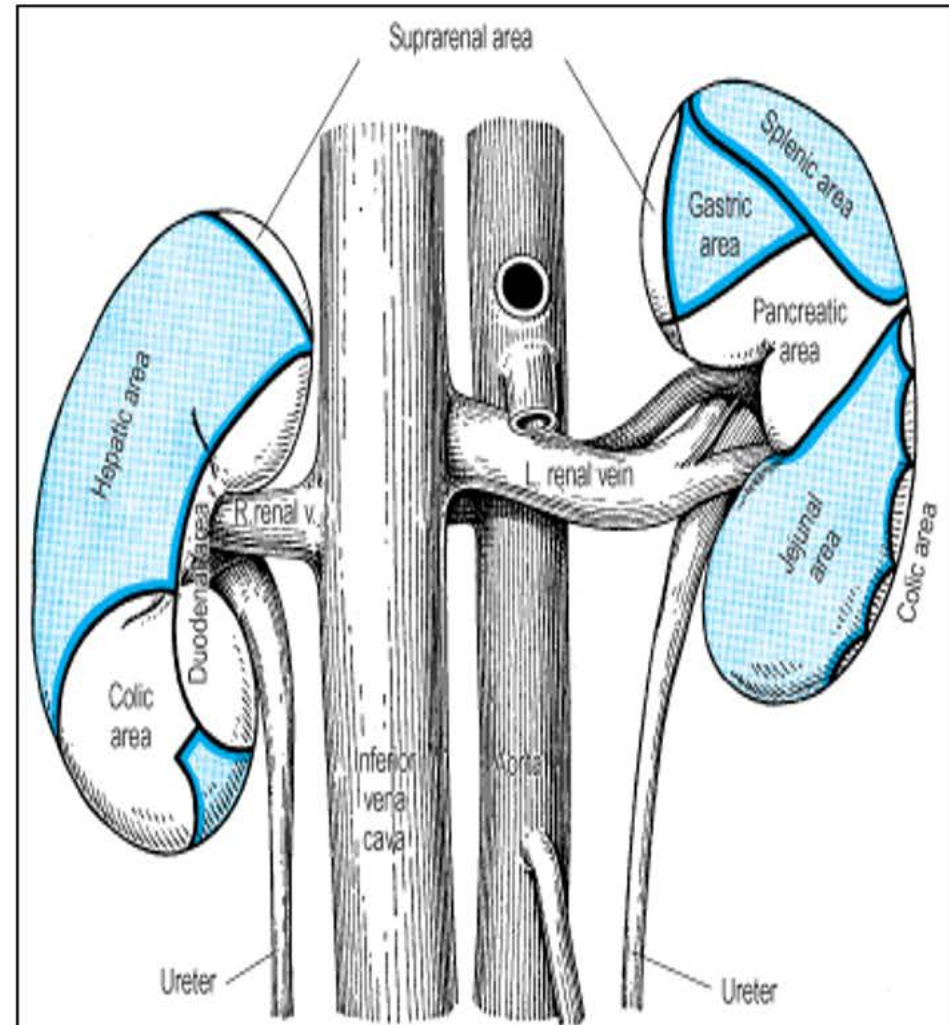
### **The arterial blood supply**

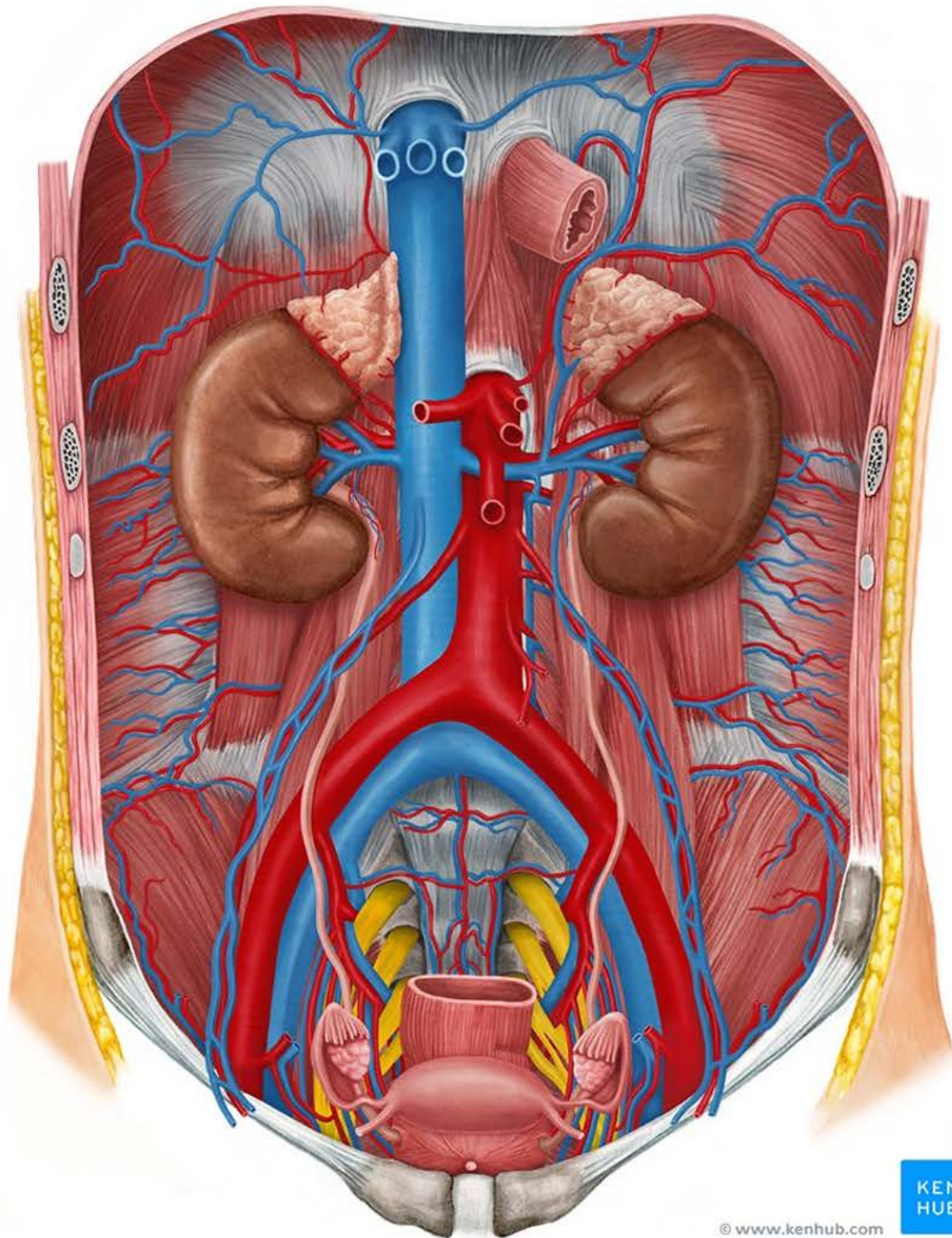
(renal artery) of the kidney originates from the aorta and enters the hilum on the medial aspect.

**Venous drainage** flows through the renal vein and into the inferior vena cava.

### **The lymphatics**

drain into the lumbar nodes. **Innervation** is from the autonomic nervous system originating in the lumbar sympathetic trunk and vagus nerve.







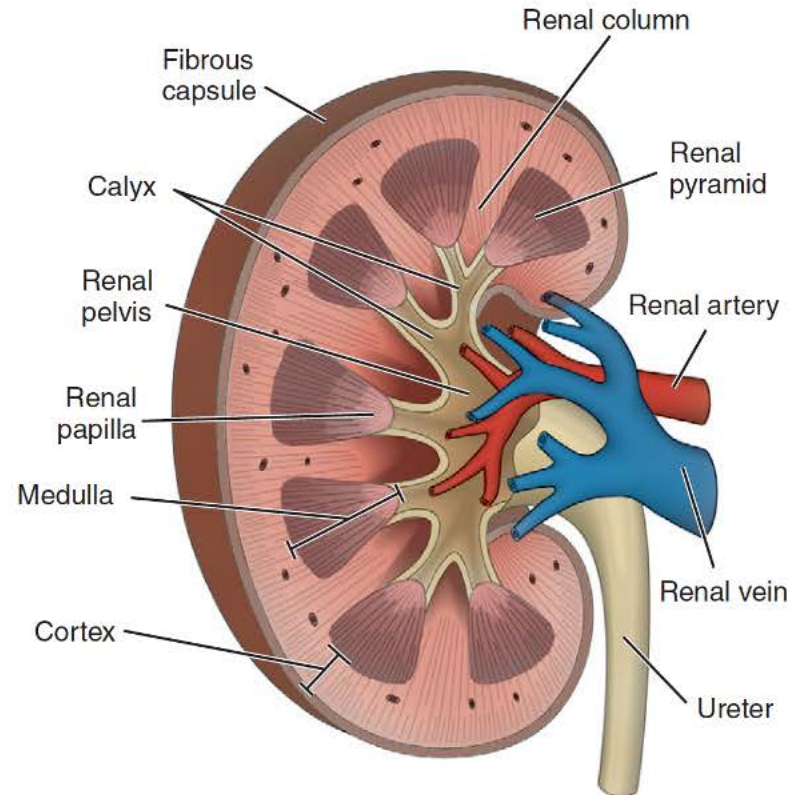
Each kidney is enclosed in a thin, fibrous capsule referred to as **Gerota's fascia**.

The renal parenchyma, the substance of the kidney within the capsule, is composed of an **external cortex and internal medulla**.

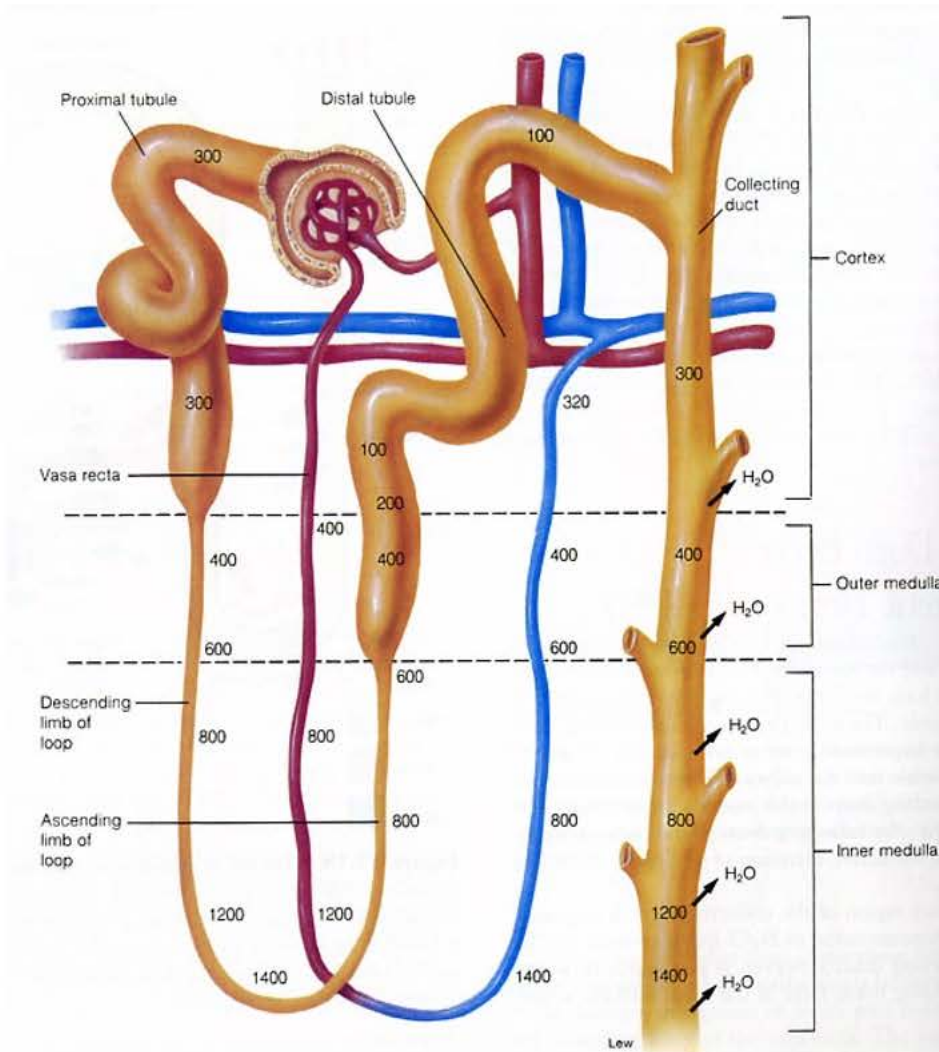
The **medulla** consists of conical segments called renal pyramids. Each pyramid and its surrounding cortex form a lobe.

Within these pyramids are the essential components of renal function: the **nephrons**.

As the urine forms, it drips from the **papillae** at the tips of the pyramidal structures.



# Functional Unit of the Kidney is the NEPHRON



Glomerulus

Proximal Tubule

Loop of Henle

Distal Tubule

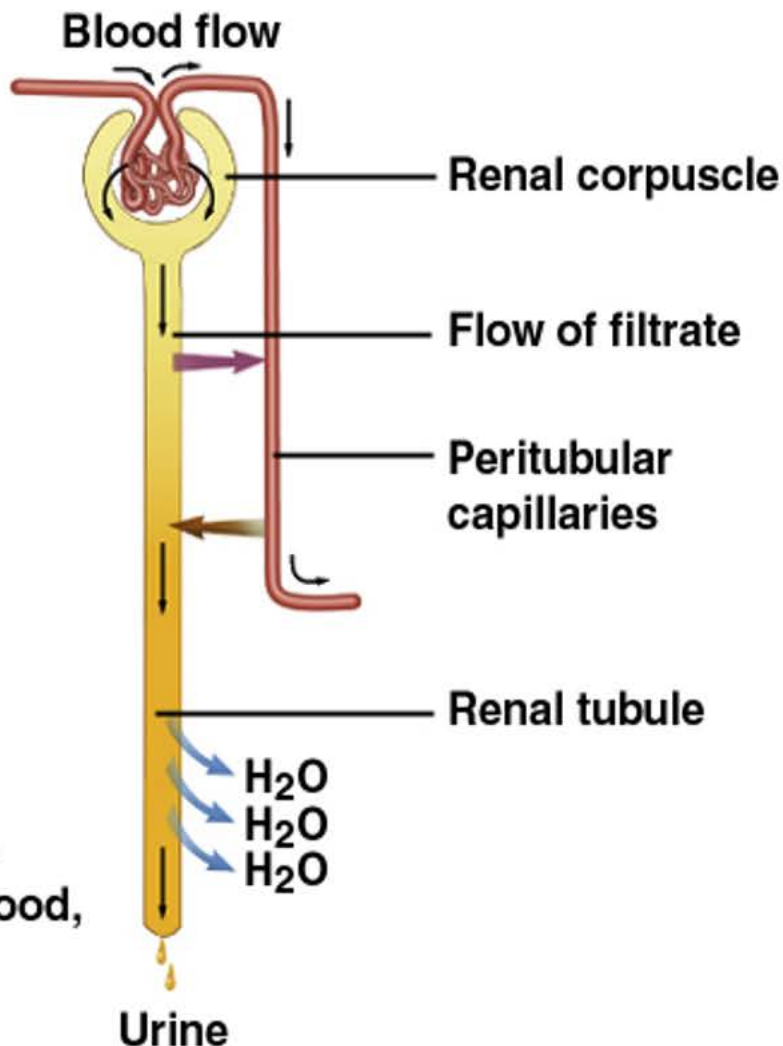
Collecting Duct

# Functions of Urinary System

- **Regulate electrolytes (K<sup>+</sup>, Na<sup>+</sup>, etc)**
- **Regulate pH in blood**
- **Regulate blood pressure**
- **Regulate blood volume (removes excess fluid)**
- **Removing metabolic wastes**
  - Urea, uric acid, and creatinine

# Urine Formation

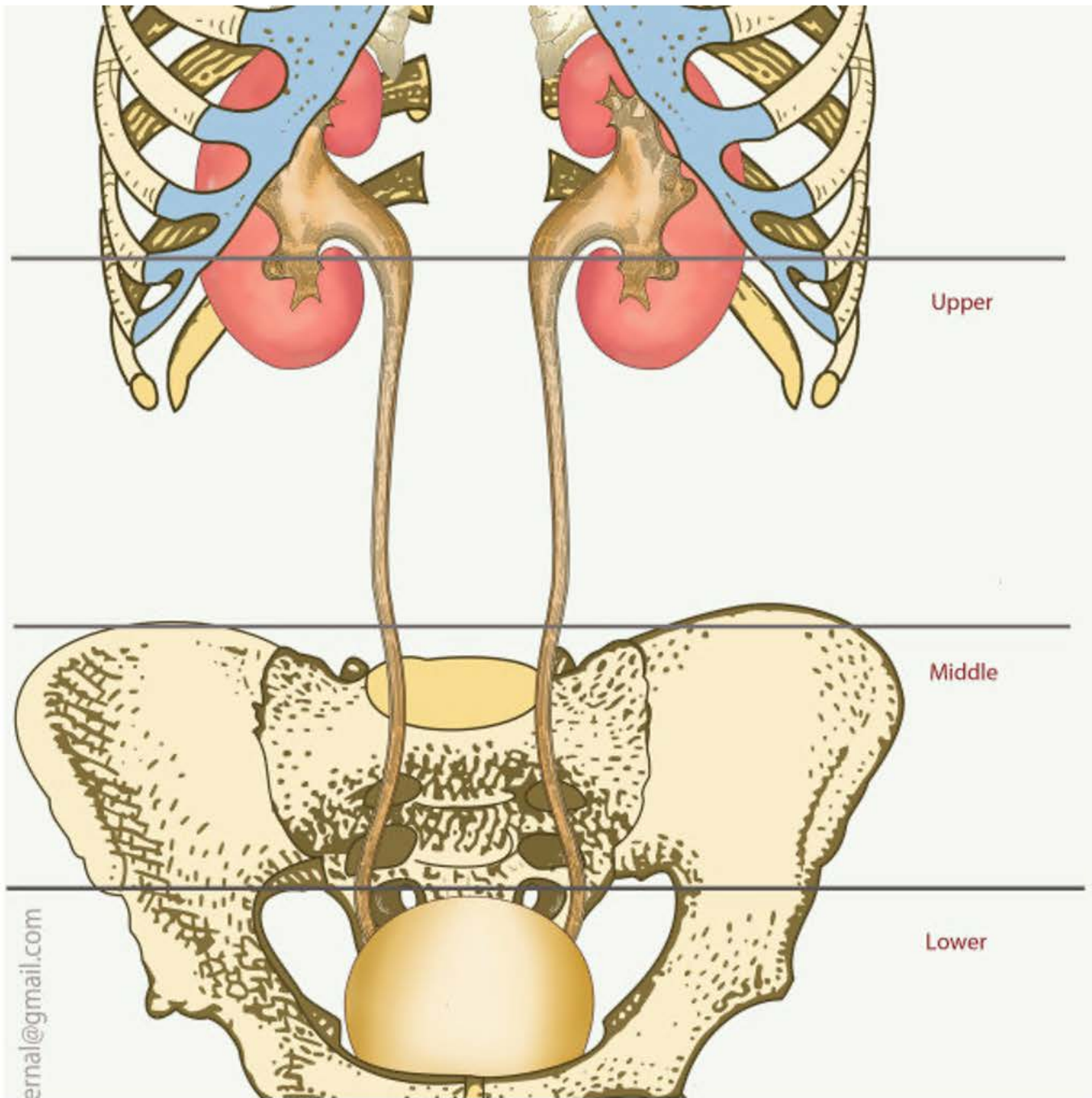
- ① **Glomerular filtration**  
Creates a plasma-like filtrate of the blood
- ② **Tubular reabsorption**  
Removes useful solutes from the filtrate, returns them to the blood
- ③ **Tubular secretion**  
Removes additional wastes from the blood, adds them to the filtrate
- ④ **Water conservation**  
Removes water from the urine and returns it to blood, concentrates wastes



# Ureters

- Connecting tubes between the kidneys and bladder;
- 4 to 5 mm in diameter, have a 0.2- to 1-cm lumen,
- Approximately 12 inches (25 to 30 cm) long.
- They lie bilaterally beneath the parietal peritoneum and descend along the posterior abdominal wall to the pelvic brim.
- From there, they pass along the lateral wall of the pelvis and curve downward, forward, and inward along the pelvic floor to the bladder.





Upper

Middle

Lower

# Ureter

- The wall of each ureter is continuous with the renal pelvis and is composed of
  - mucous membrane,
  - longitudinal and circular muscles,
  - an outer layer of fibrous and elastic tissue.
- Slow, rhythmic, peristaltic contractions carry urine from the kidneys to the bladder in response to filling of the renal pelves.

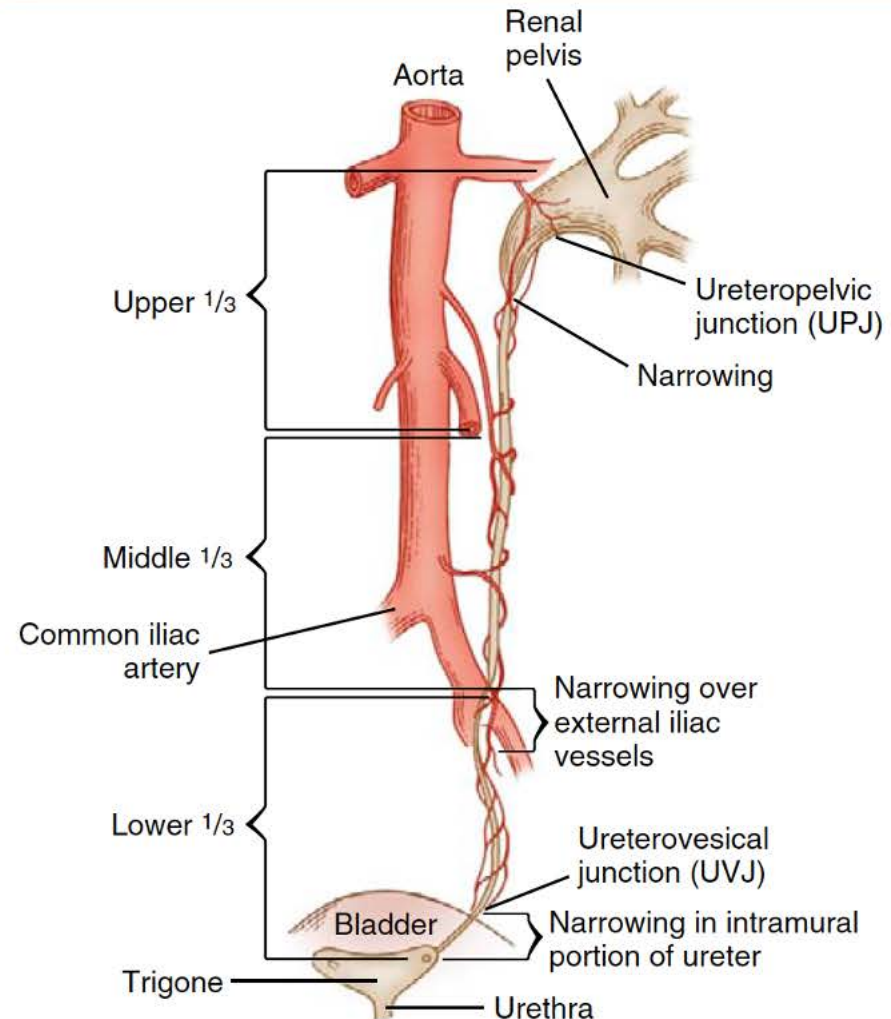
# THE URETER

## SITE OF CONSTRICTION (OBSTRUCTION-STONE IMPACTION)

- At ureteropelvic junction
- At pelvic inlet (site of crossing of common iliac artery)
- At site of entrance to bladder

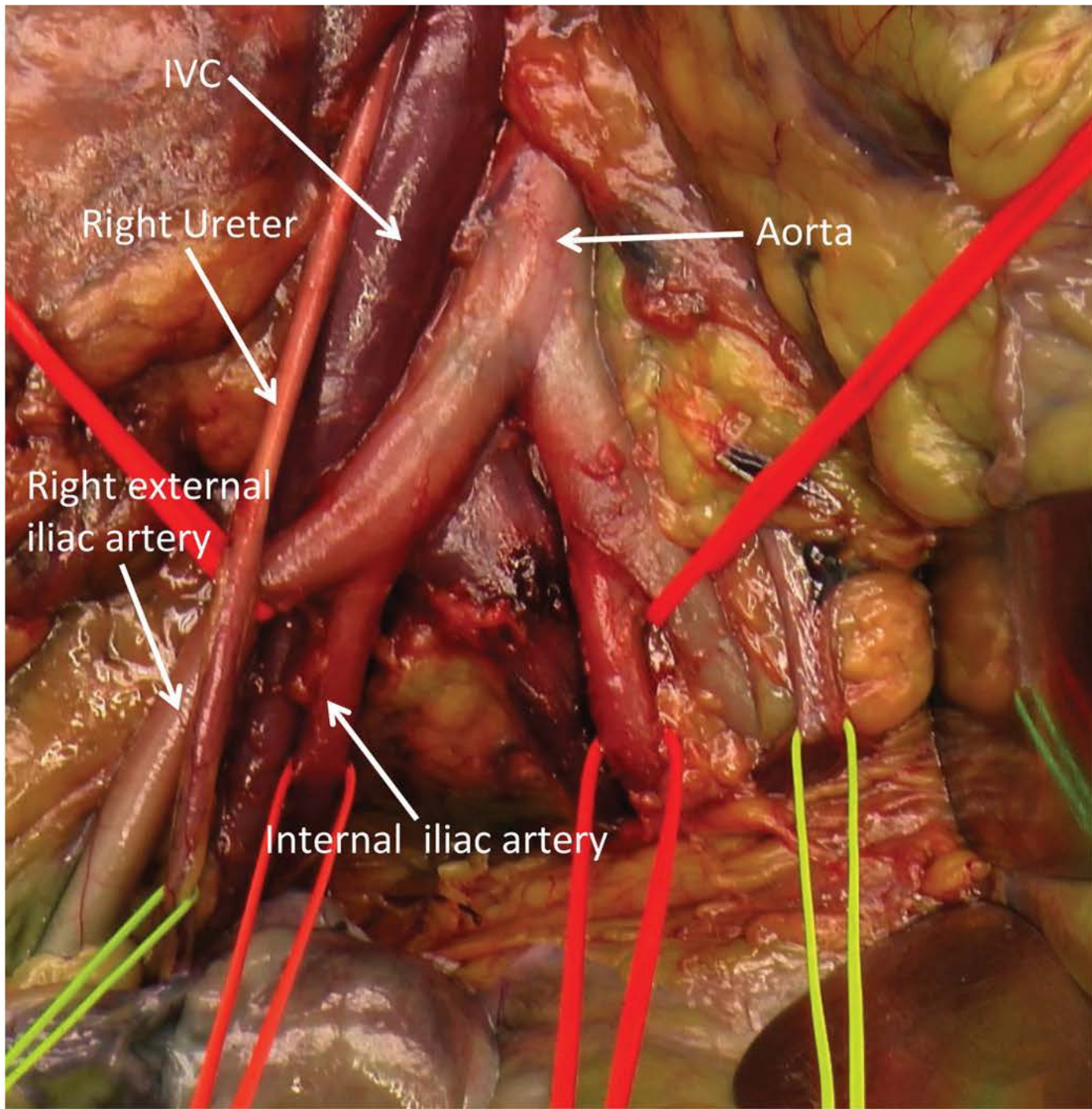
## ARTERIAL SUPPLY:

- Renal artery
- Gonadal artery
- Common iliac artery
- Internal iliac artery



**FIGURE 14-4** Anatomy of ureter.





IVC

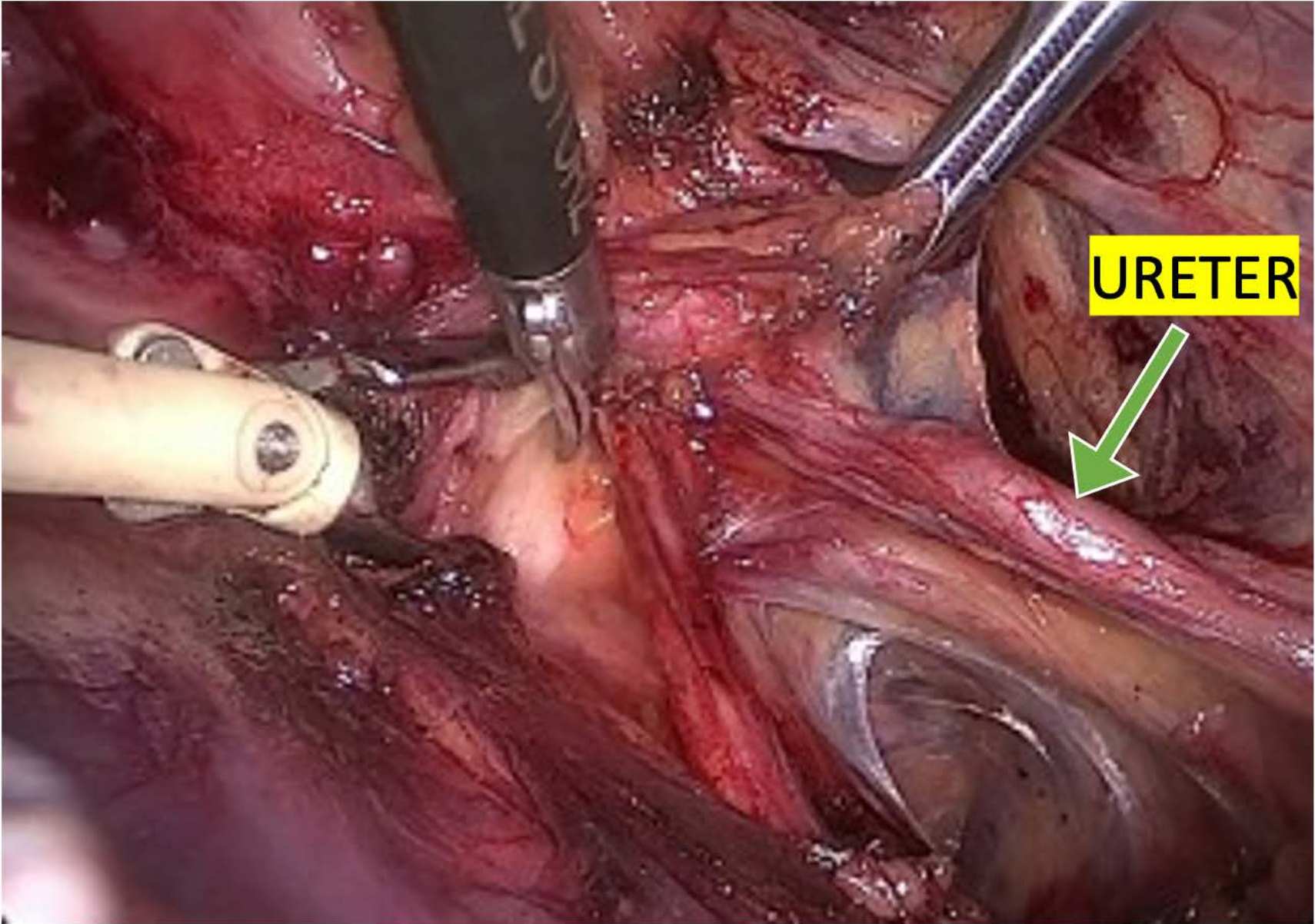
Right Ureter

Aorta

Right external  
iliac artery

Internal iliac artery





# URINARY BLADDER

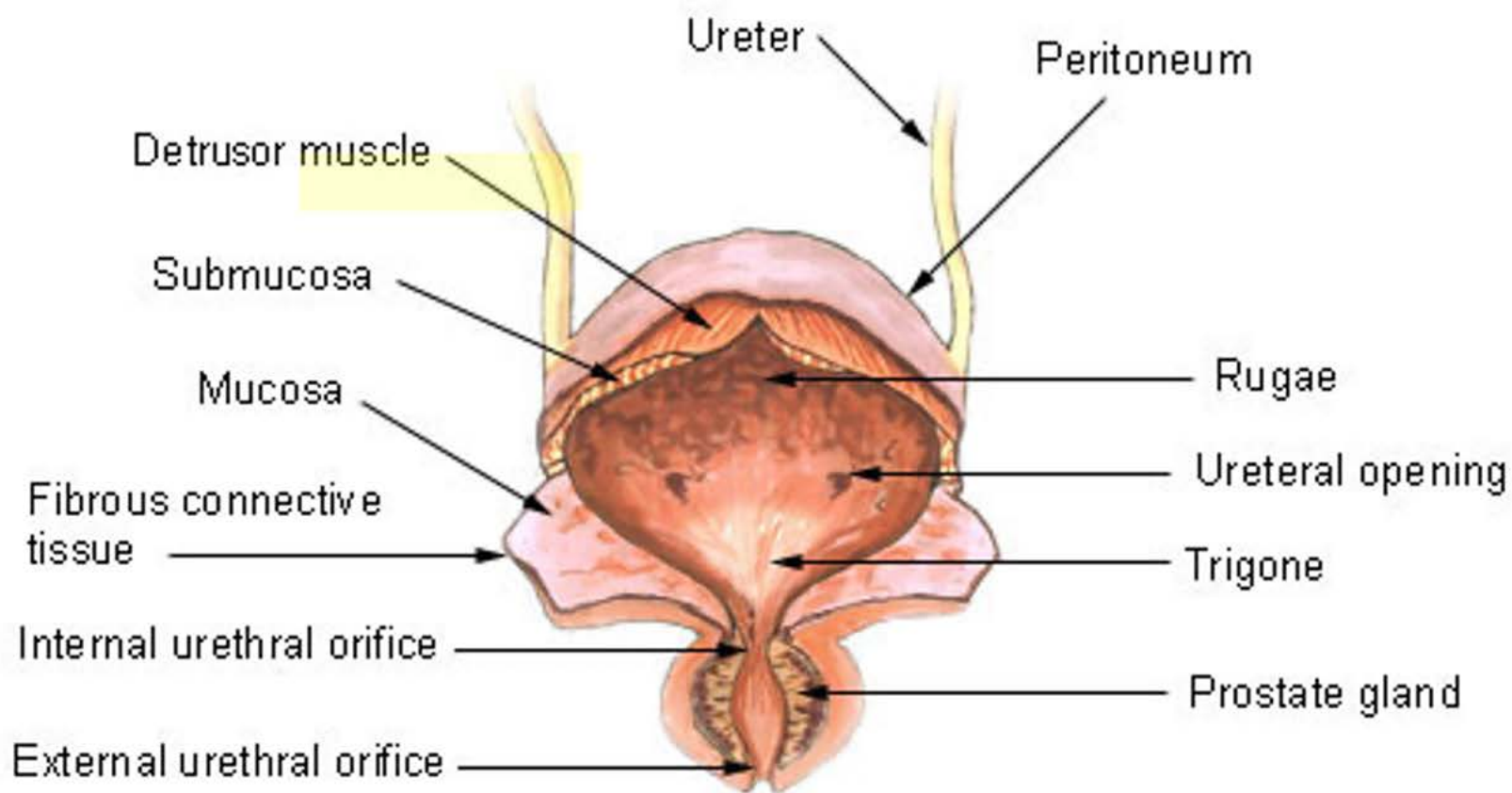
- The bladder is a hollow muscular reservoir lined with mucous membrane;
- it is located extraperitoneally in the anterior pelvic cavity behind the symphysis pubis.
- The ureters enter the bladder wall obliquely on each side.
- The triangular area between the ureteral and urethral orifices is called the trigone.

# URINARY BLADDER

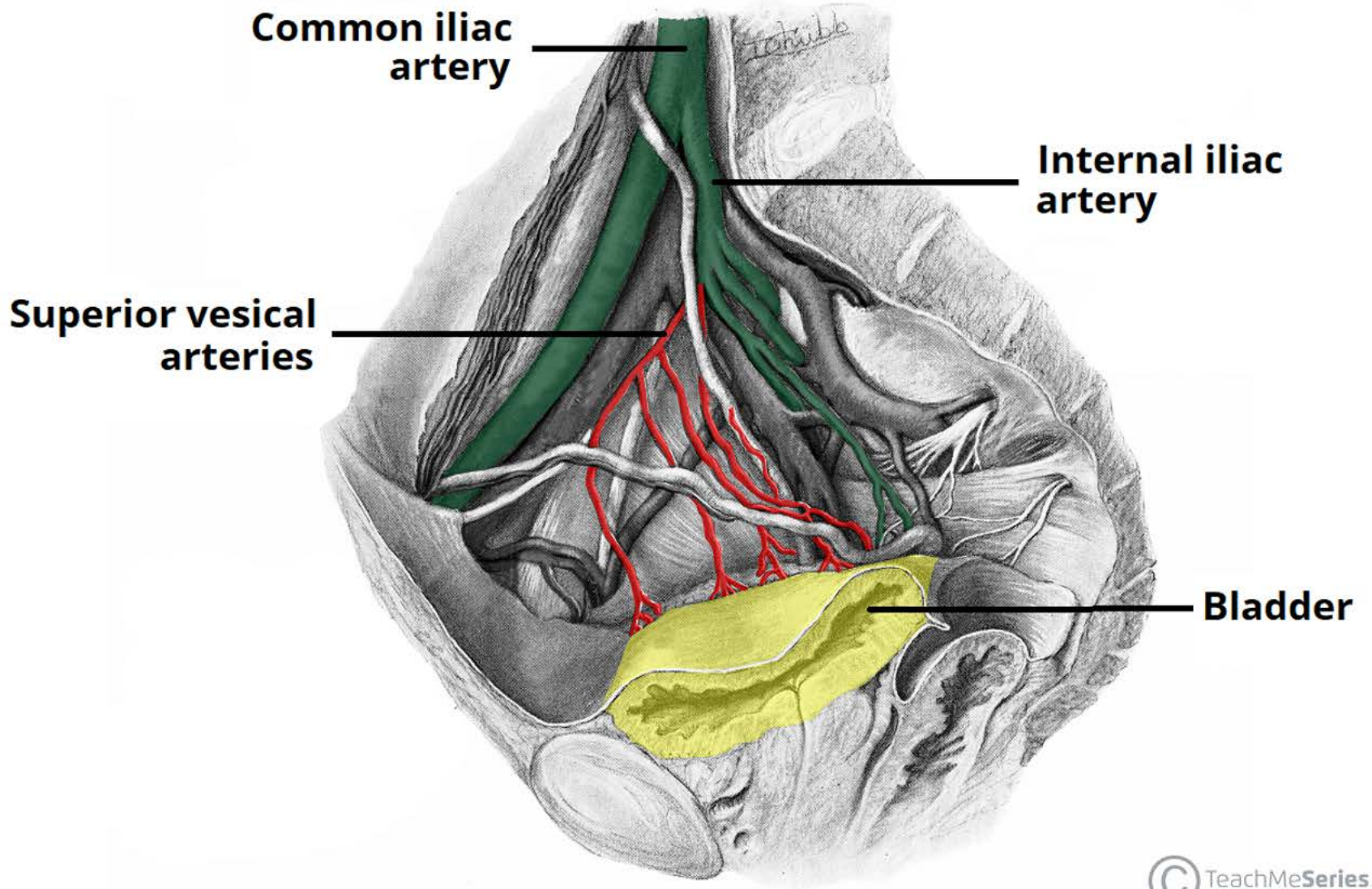
- Folds of mucous membrane in the bladder wall act as valves to prevent the backflow of urine into the ureters.
- Urine collects in the bladder until an autonomic nerve stimulus from the sacral reflex centers causes micturition (urination) through the urethra.
- This stimulus opens the muscle fibers that form an internal sphincter at the bladder neck, the vesicourethral junction.

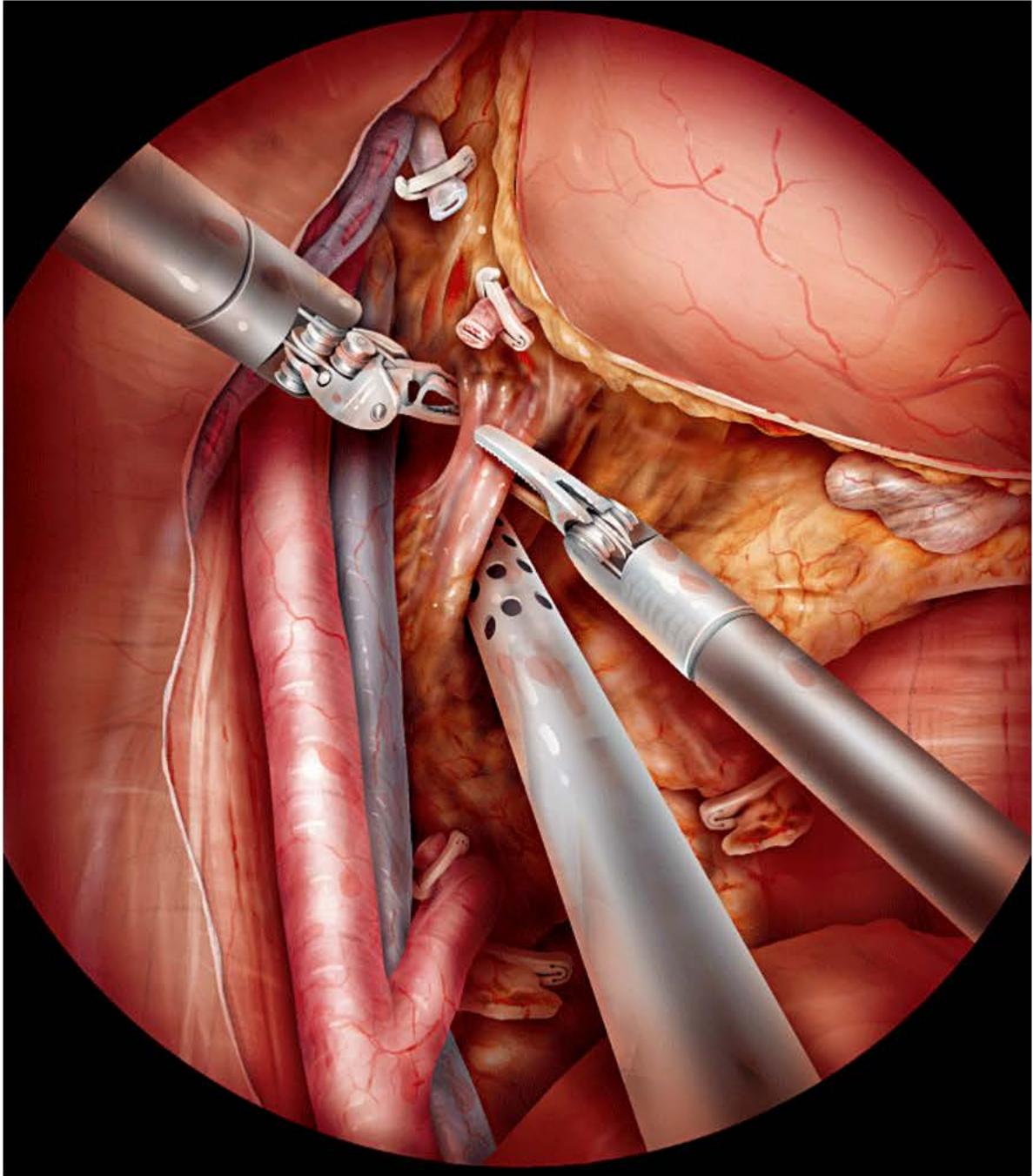
# Detrusor Muscle

## Urinary Bladder









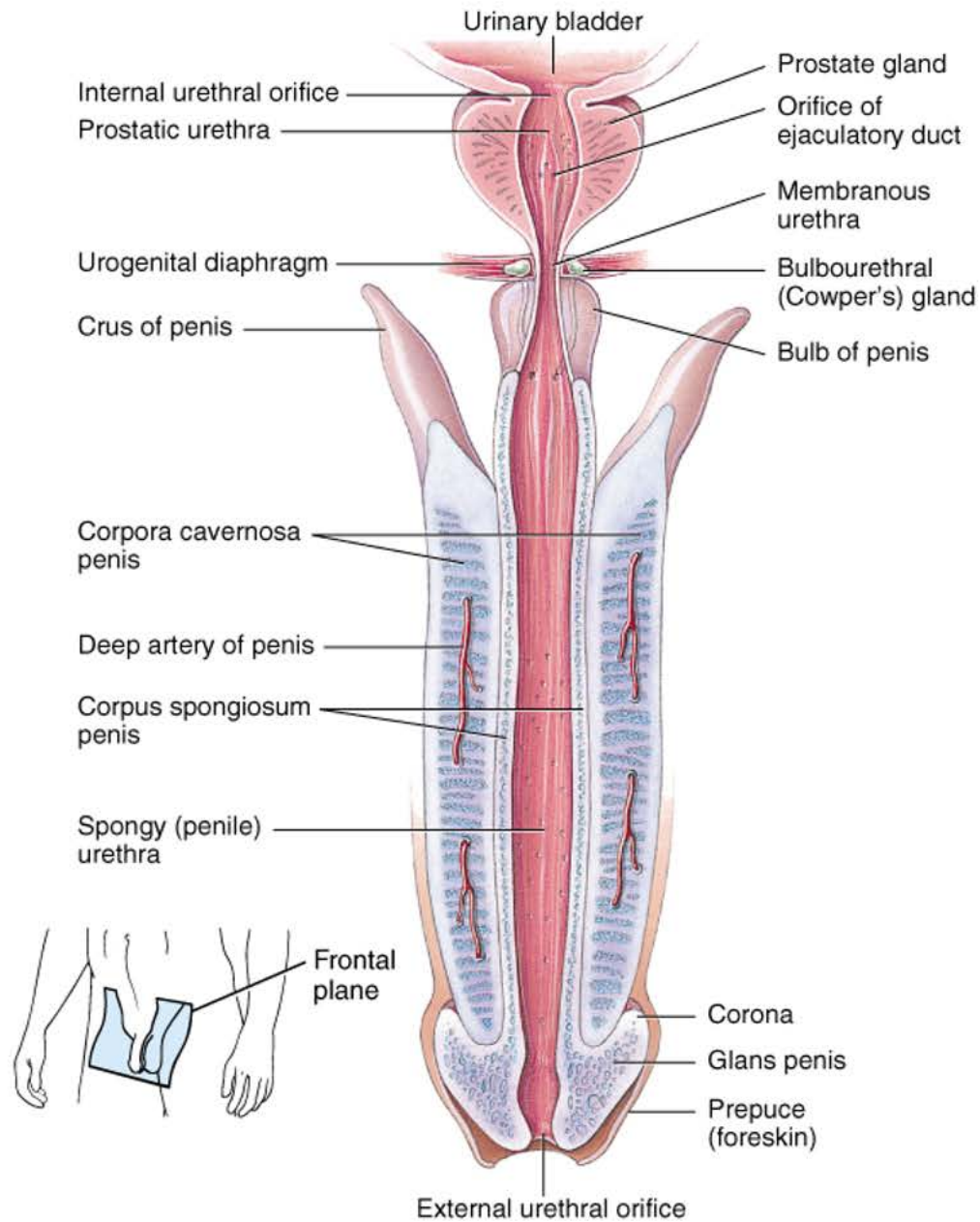
# Bladder innervation

- The parasympathetic fibers from S3 to S5
  - promote emptying by contraction of the detrusor muscles.
- The sympathetic nerve fibers from L1 to L2
  - relaxation of the detrusor muscles and closure of the internal urinary sphincter, allowing the bladder to fill.
- Somatic innervation from S2 to S4
  - the external urinary sphincter → voluntarily control to contract the musculature.

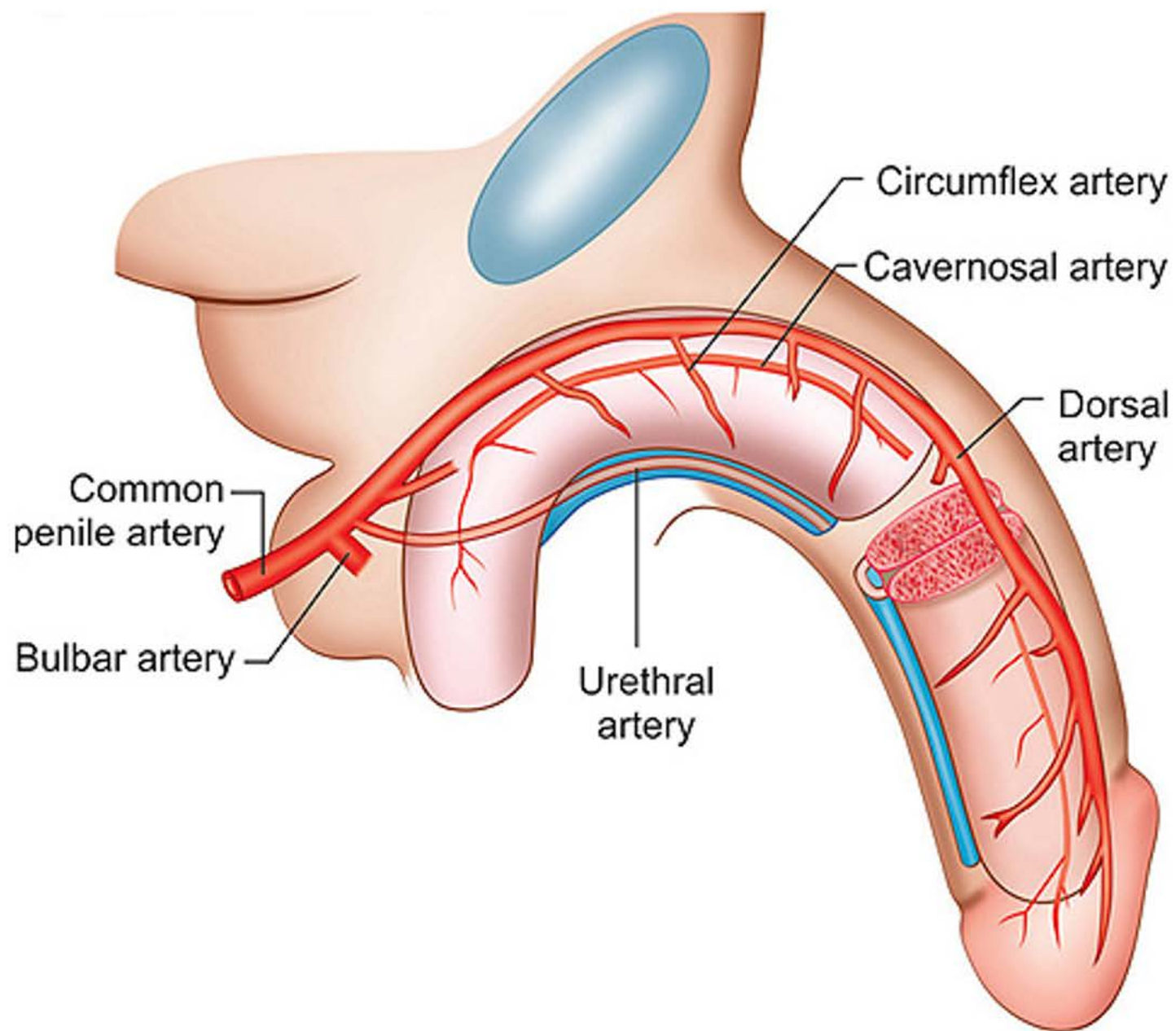
# Urethra

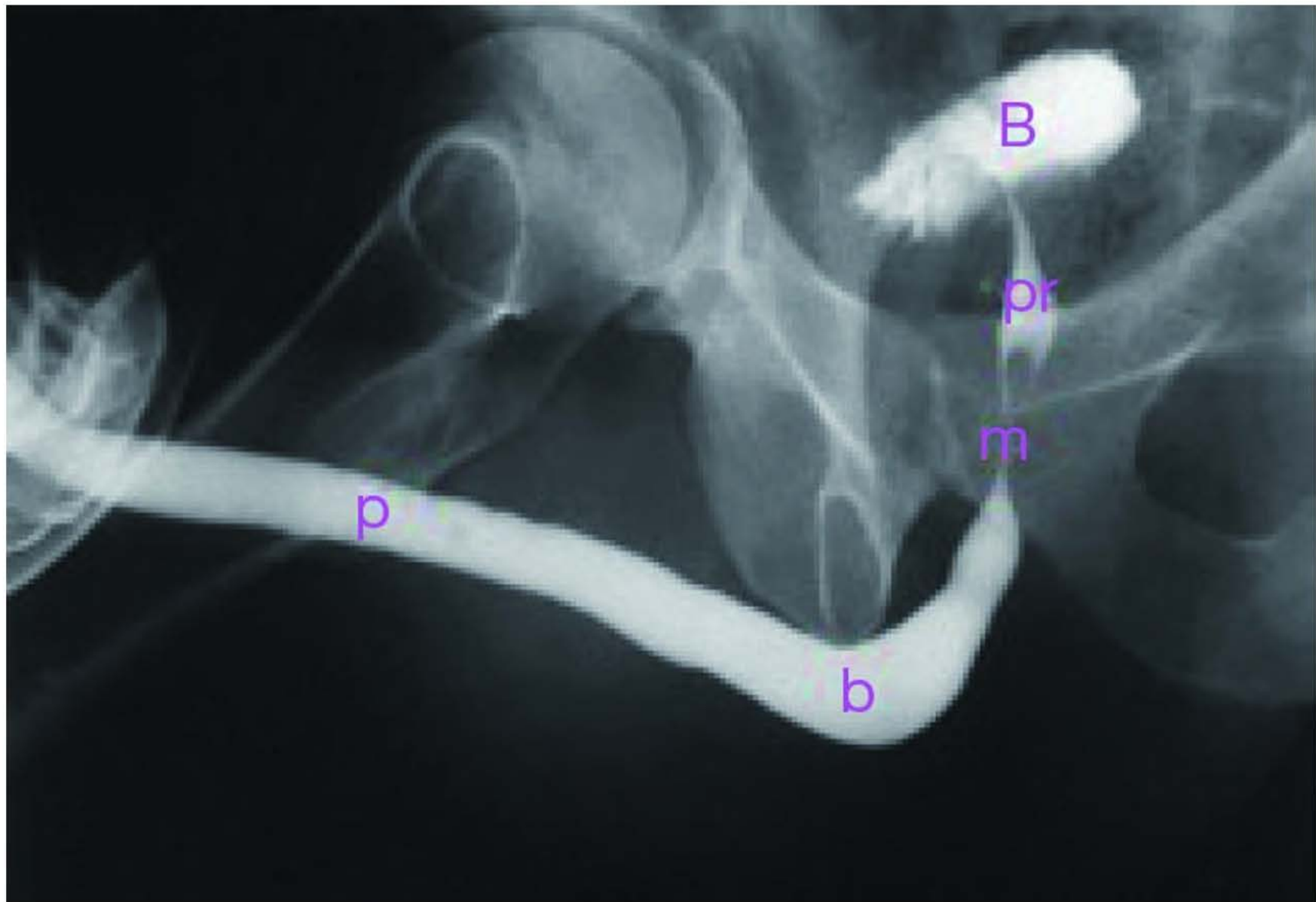
- **Drains the urine to the outside.**
- **Females: 3-5cm / diameter of 6 to 8 mm**
- **Males 25-30 cm / diameter of 7 to 10 mm**
  
- **Therefore, women (esp. little girls) are more susceptible to urinary tract infections (UTI).**





(a) Frontal section





- **Male Reproductive System**



# General Organization



- **Gonads**  $\Rightarrow$  **gametes & hormones**
- **Ducts**  $\Rightarrow$  **transport of . . . ?**
- **Glands**  $\Rightarrow$  **secrete fluid**
- **Perineal structures = external genitalia**

# Male Reproductive System

## A. Functions

1. Spermatogenesis – production of reproductive cells (sperm)
2. Copulation – transfer of sperm to female
3. Production of hormones

## B. Structures

1. Scrotum
  - A) Protective sac around testes
  - B) B) Regulate temperature (92°F/33°C)

# Male Reproductive System

## 2. Testes

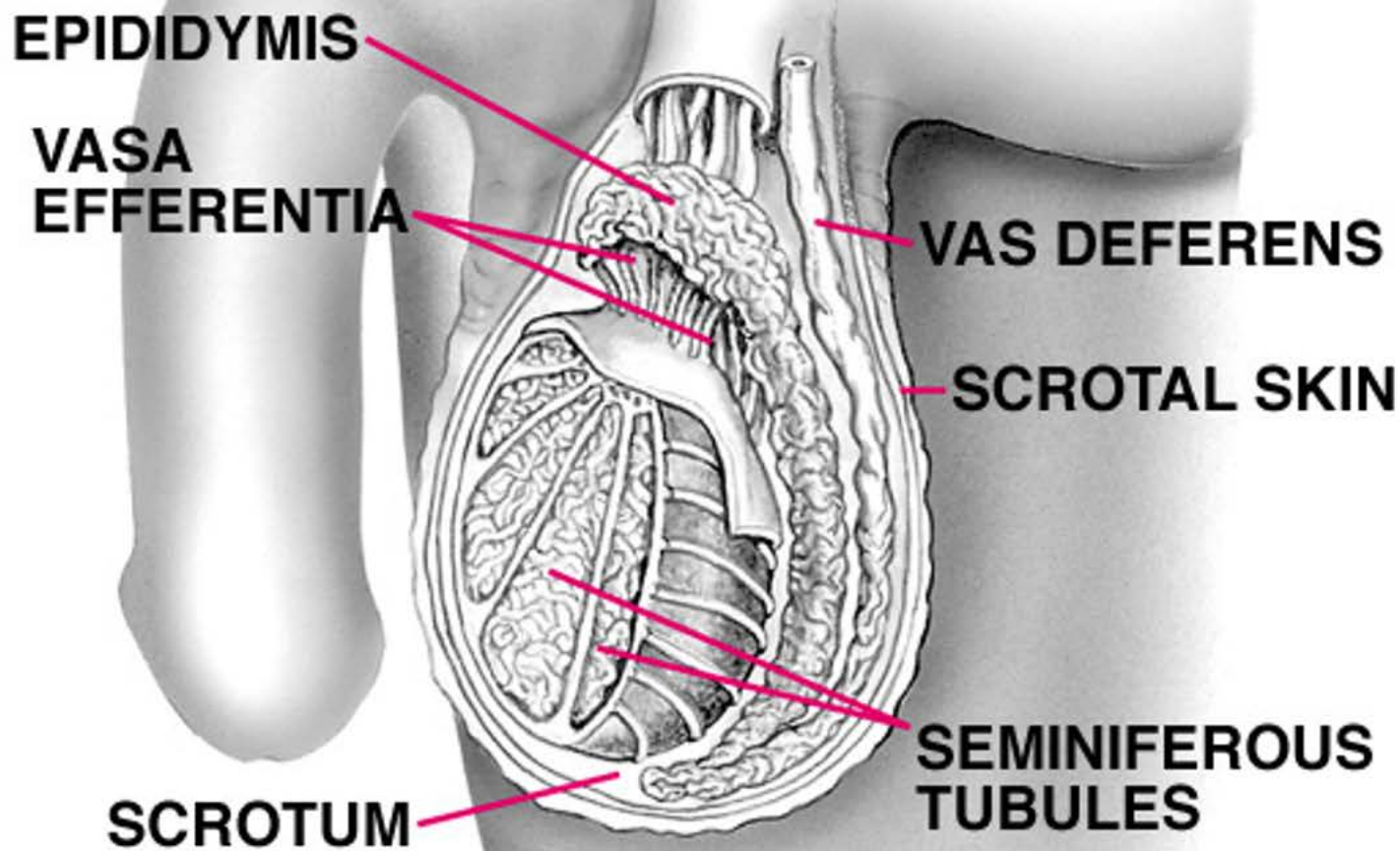
A) Site of spermatogenesis & hormone production

B) Structures

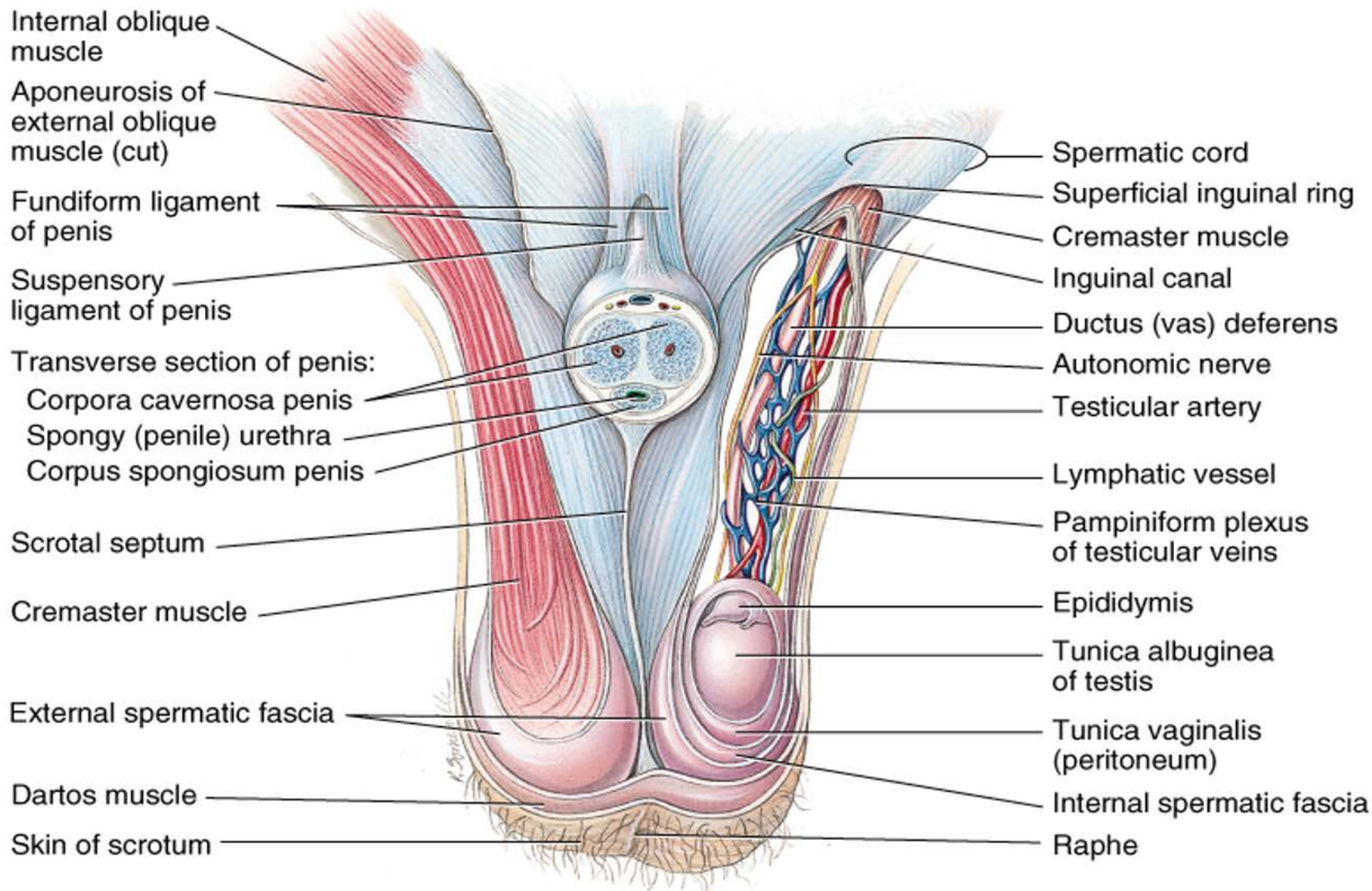
1) Tunica albuginea – outer cell layer

2) Each testis is subdivided into lobules

# Testes







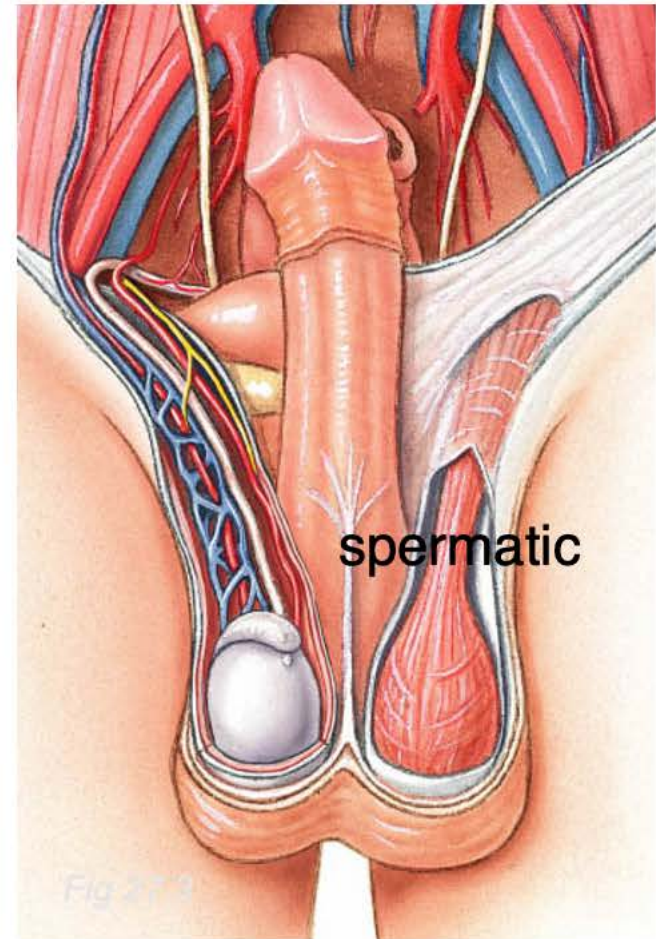
Anterior view of scrotum and testes and transverse section of penis

# Spermatic Cord

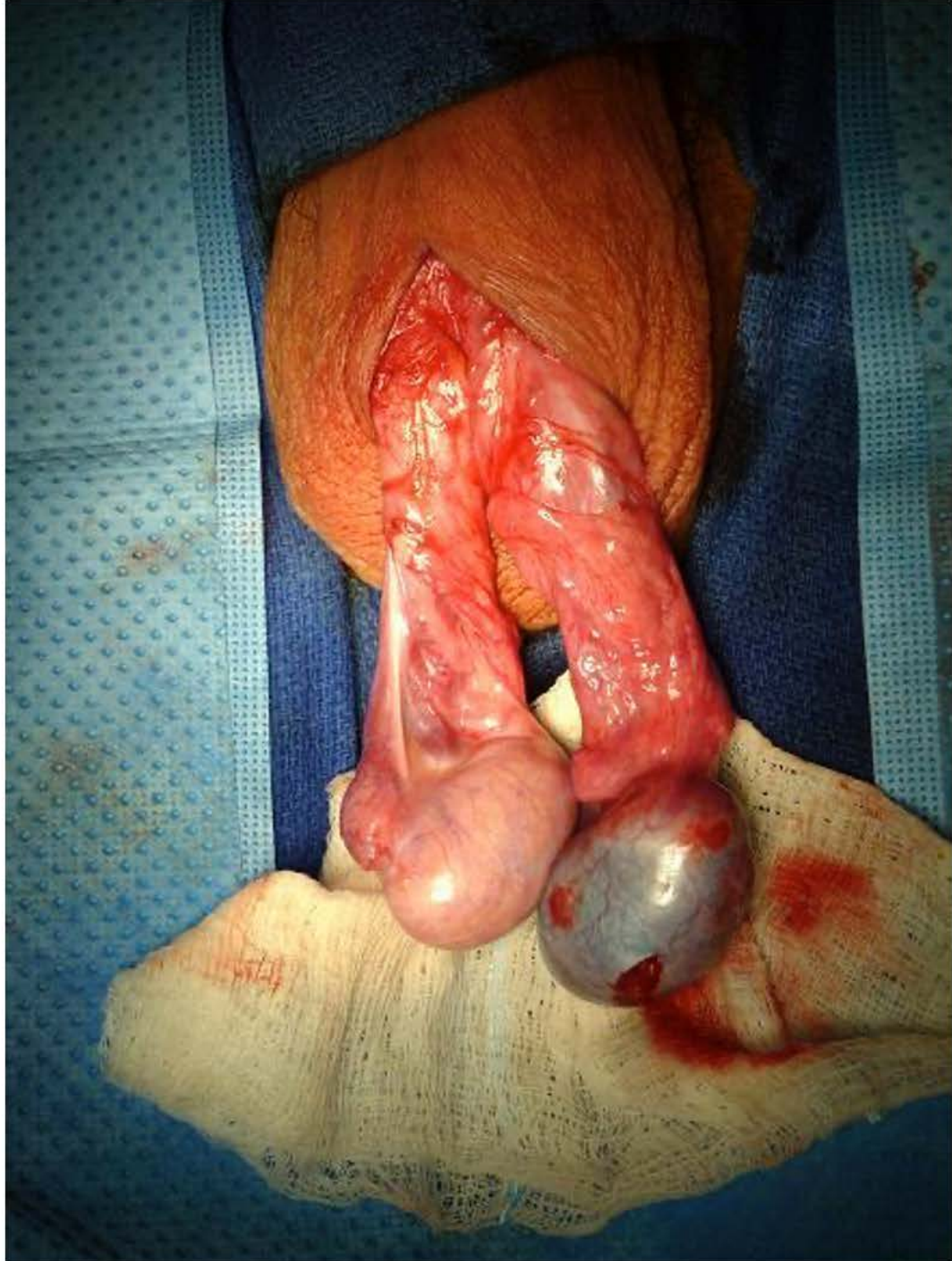
Can be palpated as it passes over the pubic brim.

## ***Constituents :***

1. Pampiniform plexus of vein
2. Spermatic artery
3. Ductus (vas) deferens
4. Lymphatics
5. Nerves-ilioinguinal and genitofemoral







# Scrotum

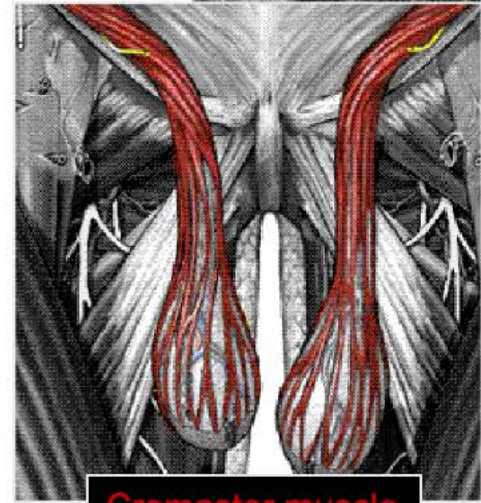
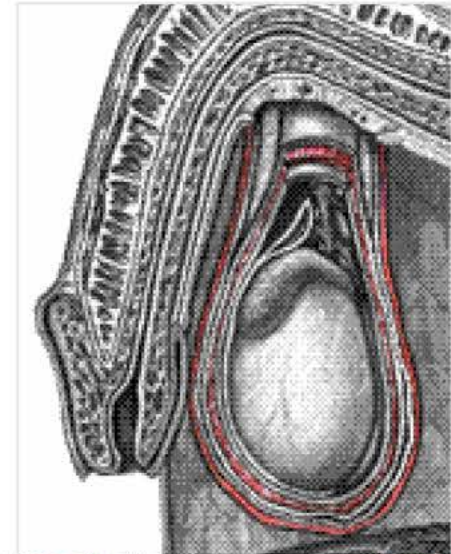
**Function: supports and protects testes**

**Structure: Skin & underlying superficial fascia**

- **Dartos muscle** in dermis
- **Cremaster muscle** - continuous with abdominal wall muscles (?)

**Involuntary contraction (cremasteric reflex)**

**Scrotal sac forms 2 separate chambers**

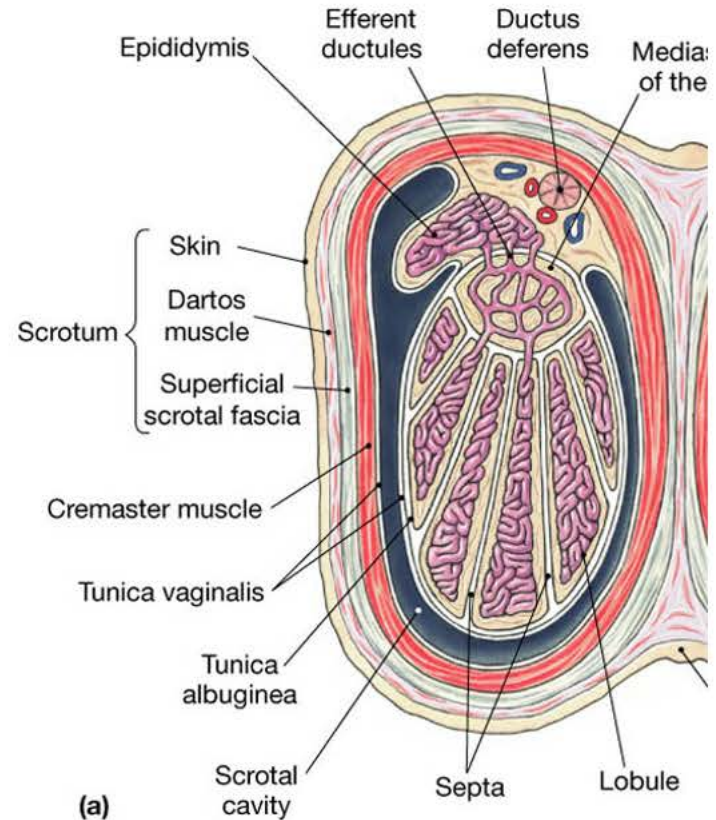


**Cremaster muscle**



# Structure of Testes

- **Fibrous capsule** – **tunica albuginea** – surrounds testes
- **Scrotal cavity** – lined by **tunica vaginalis** – parietal and visceral layers
- **200-300 lobules**
- **3 seminiferous tubules**



# Epididymis

~ 7 m long

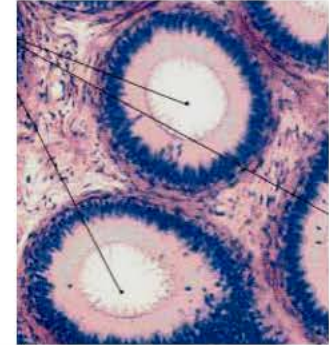
**Head** - superior, receives spermatozoa

**Body** - distal and inferior

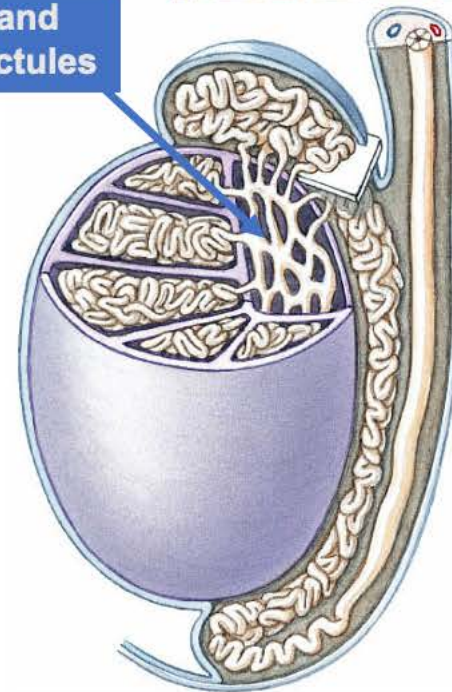
**Tail** - leads to ductus deferens

*Functions:*

- A) Site of sperm maturation and storage
- B) Takes 20 days for sperm to travel through it
- C) Can store sperm for several months

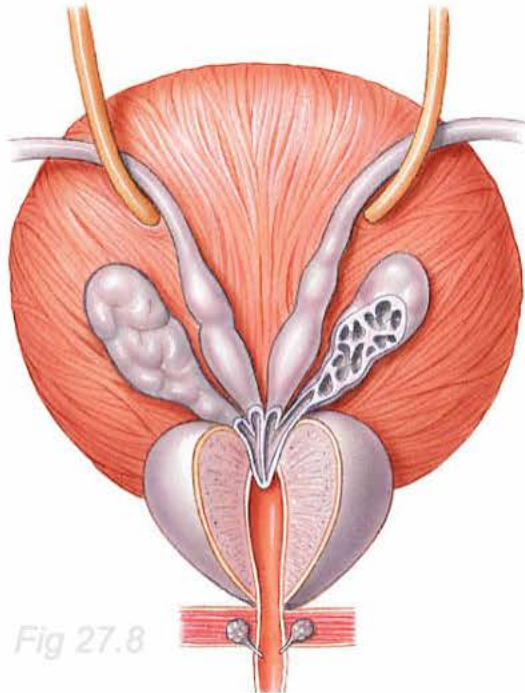


Rete testis and  
Efferent ductules

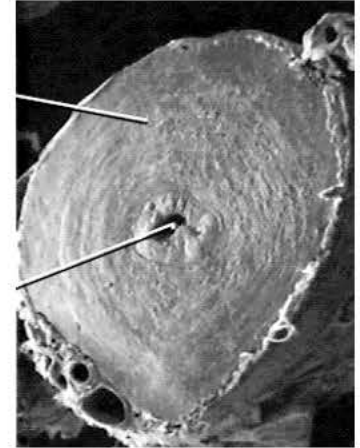


(a) Testis and epididymis

## Pathway of Sperm



- Seminiferous tubules
- Rete testis
- Epididymis
- Vas (ductus) deferens
- Ampulla of vas deferens
- Ejaculatory duct
- Prostatic urethra
- Membranous urethra
- Penile (spongy) urethra



# Accessory Glands



Provide for 95% of the seminal fluid

## 1) Seminal Vesicles

- **Paired, on back wall of urinary bladder**
- **Tubular** (~ 15 cm)
- **Produce 60% of semen, hormones, fructose, etc.**
- **Activate sperm (leading to motility)**



# Seminal vesicles

- A) Yellowish, finger-shaped structures
- B) Slightly inferior and posterior to bladder
- C) Produces a component of semen (60%)
  - 1) Slightly alkaline
  - 2) Contains fructose to fuel the sperm
  - 3) Also contains prostaglandins to initiate smooth muscle contractions in female reproductive tract

# Prostate Gland

**20 - 30% of seminal fluid**

**Single, doughnut-shaped**

**Secretion contains:**

- Citrate
- Seminal plasmin (mild antibiotic)
- Prostate specific antigen (PSA) – blood test for ?



# Scrotal surgeries

# Hydrocelectomy

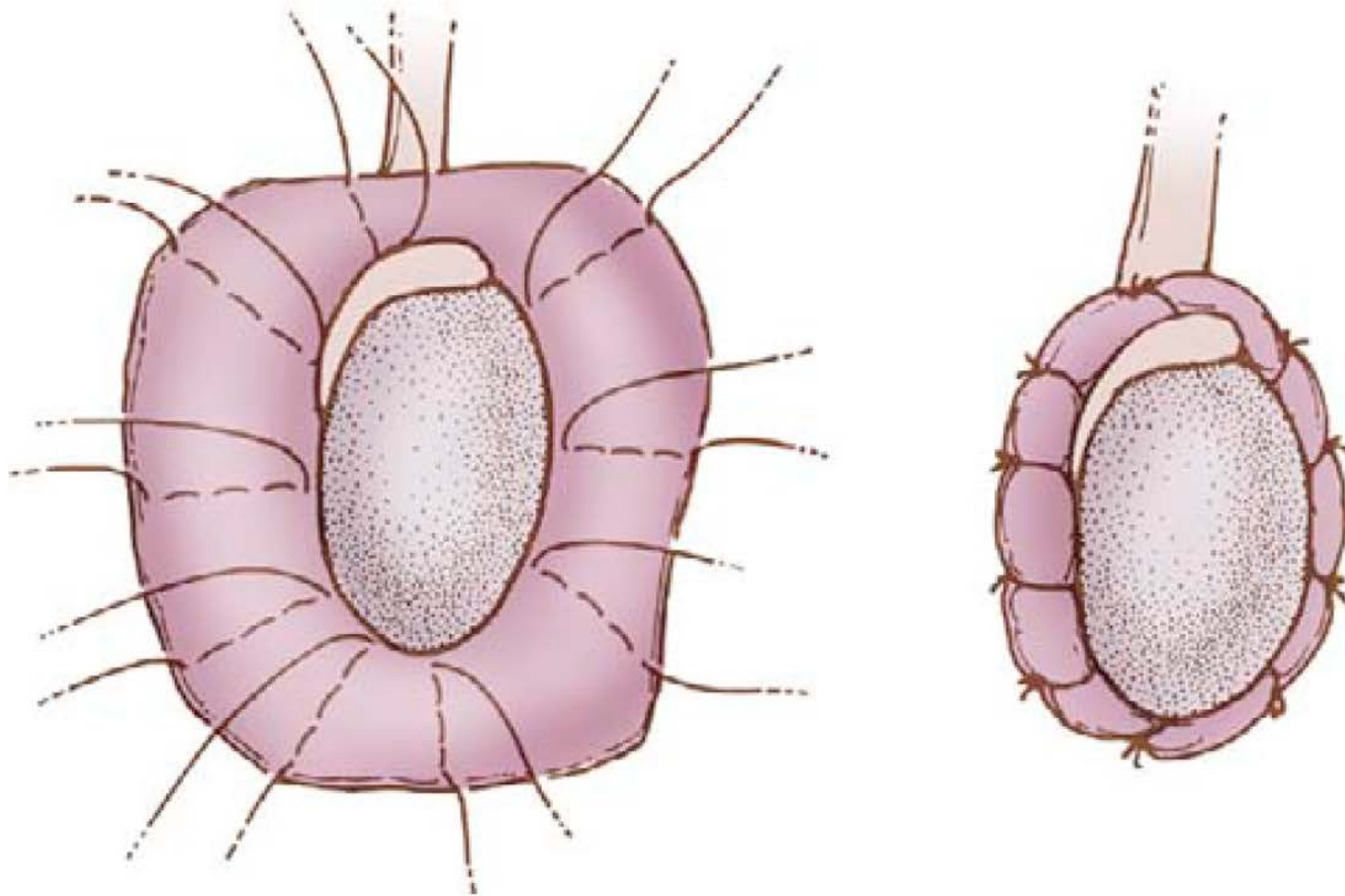
- A hydrocele is an abnormal accumulation of fluid within the scrotum.
- The fluid is contained within the tunica vaginalis.
- Excessive secretion or accumulation of hydrocele fluid may be the result of infection or trauma.
- A hydrocelectomy is the excision of the tunica vaginalis of the testis to remove the enlarged, fluid-filled sac.

# Hydrocelectomy

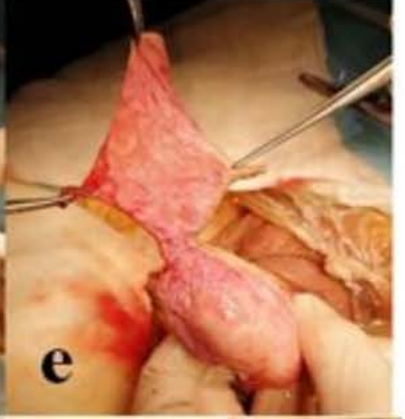
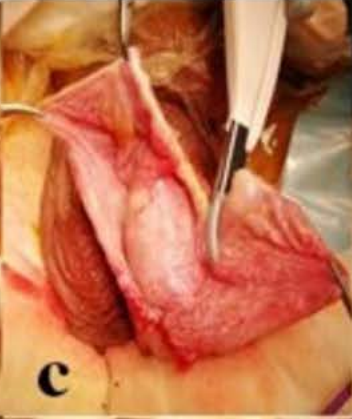
- Operative Procedure

- An anterolateral incision
- The fascial layers are incised to expose the tunica vaginalis.
- Sharp and blunt dissection to free the hydrocele.
- The sac is opened
- Evert the incised edges. Excess tunica vaginalis may be excised.
- A pouch is created by dissecting
- suture the tunica edges along the peritoneal surface with 3-0 absorbable suture

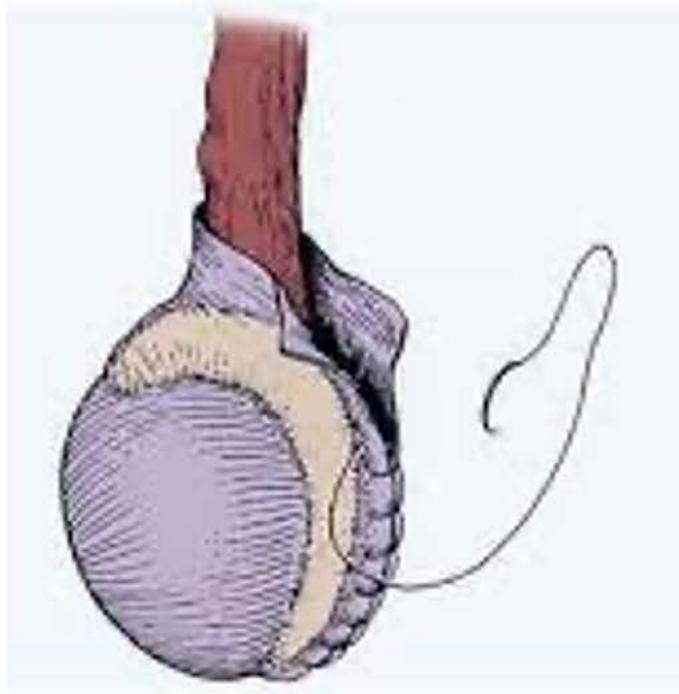




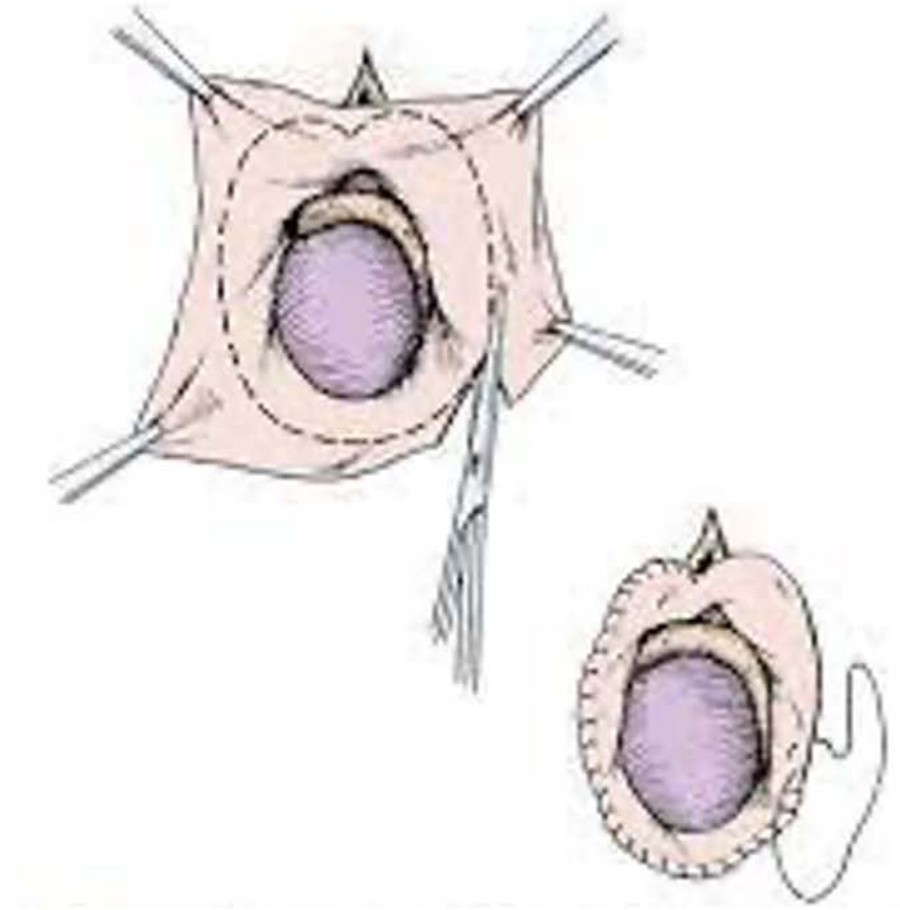
**FIGURE 14-29** Hydrocelectomy.



bottleneck



excisional



# Varicocelelectomy

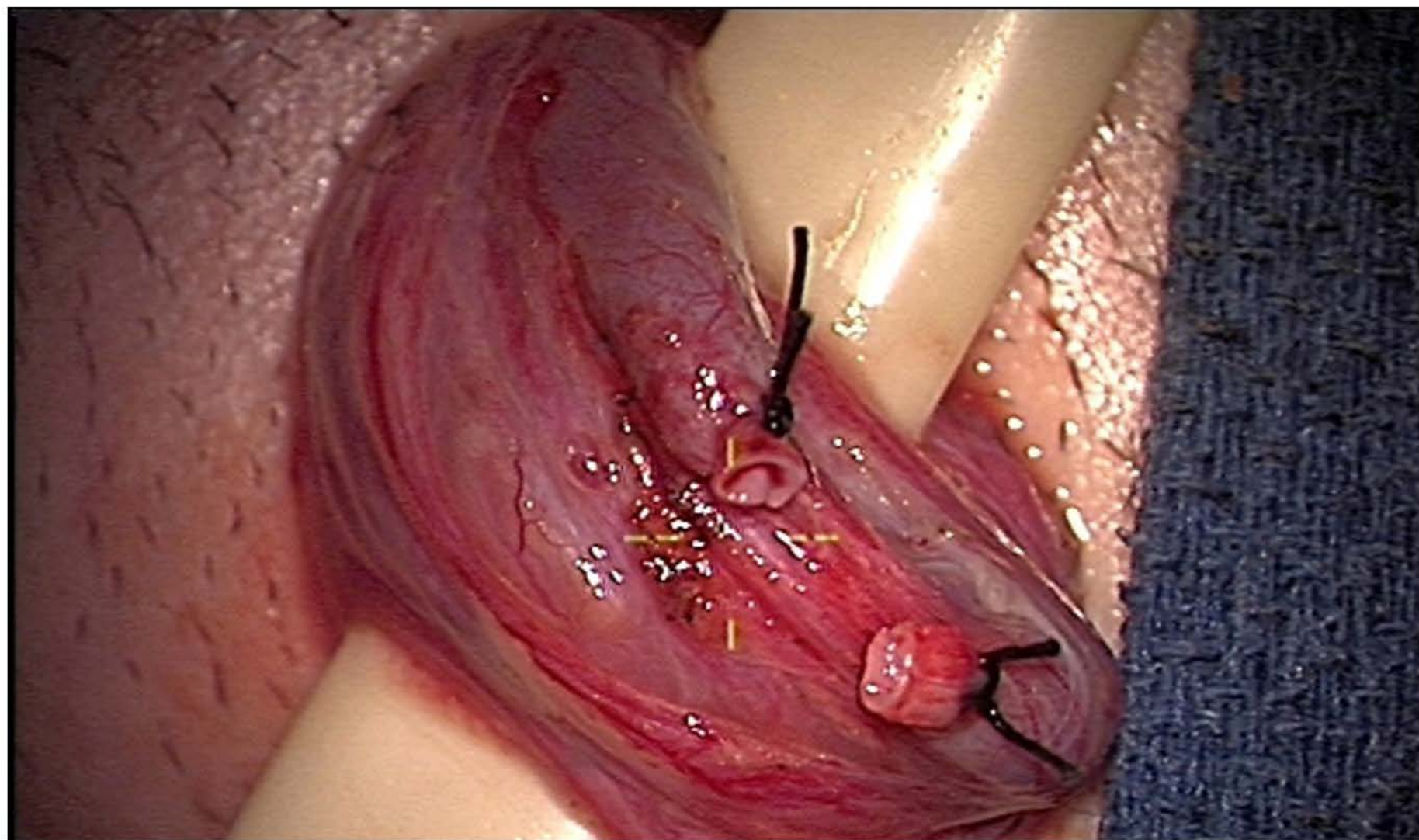
- A varicocelelectomy is the high ligation of the gonadal veins of the testes.
- Varicocelelectomy is done to reduce venous backflow of blood into the venous plexus around the testes and to improve spermatogenesis.
- More frequent on left side
- Bag of worms.

# Varicocelectomy

- Operative technique
- The surgeon identifies the structures of the spermatic cord and dissects the vessels free from the vas deferens.
- The abnormal dilated veins in the inguinal canal are clamped and ligated. The redundant portions are excised.
- A drain may be placed.
- The incision is closed in layers









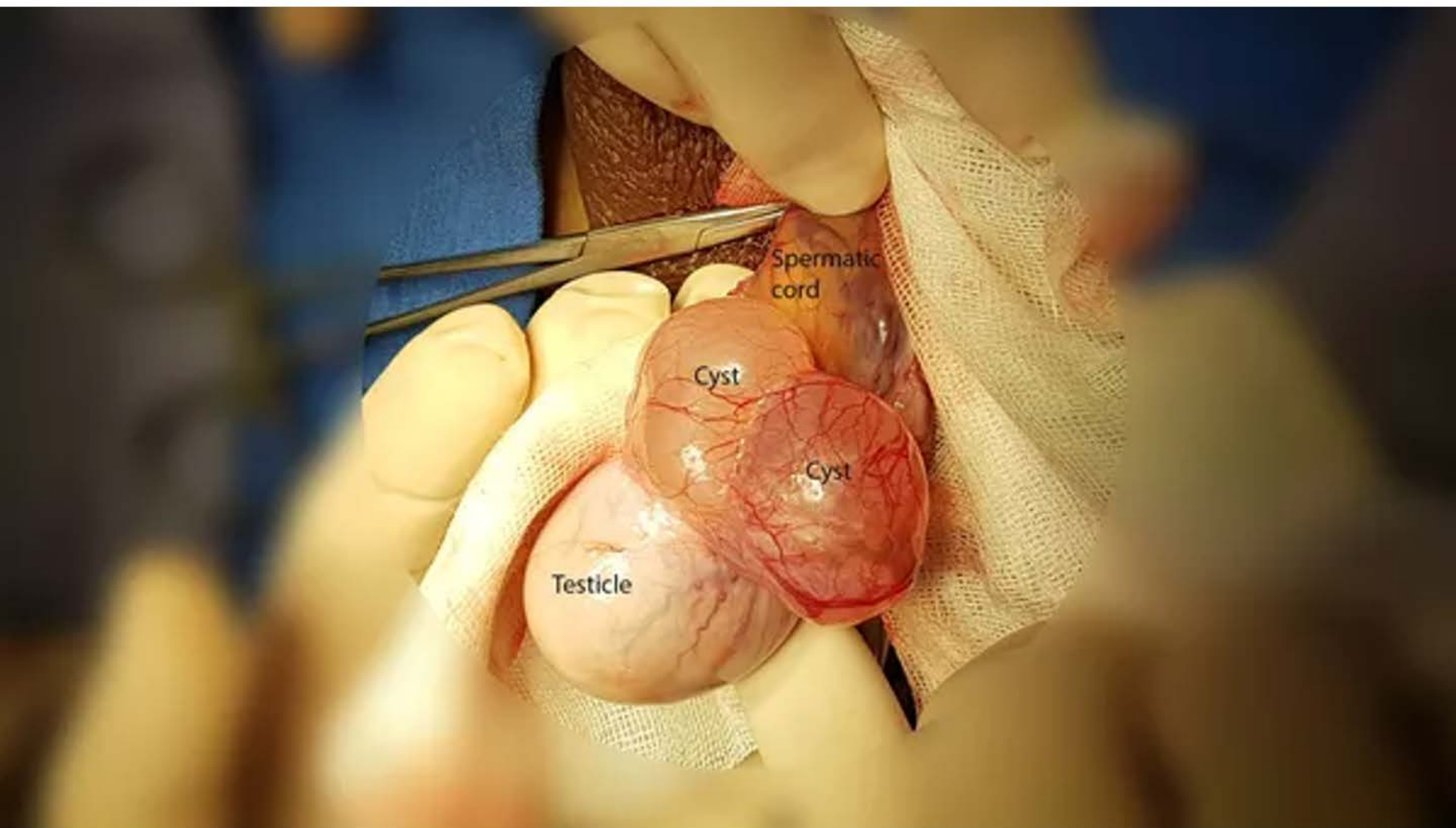
# Spermatocelelectomy

- Spermatocelelectomy is removal of a spermatocele—a lobulated intrascrotal cystic mass attached to the superior head of the epididymis.
- Spermatocele is usually caused by an obstruction of the tubular system that conveys the sperm and may be a late complication after vasectomy

# Spermatocoelectomy

- Operative technique
  - The mass is approached through a scrotal incision as described for hydrocoelectomy.
  - The surgeon identifies the structures of the testis and spermatic cord and dissects the cystic structure free.
  - Bleeding is controlled with electrocoagulation.
  - The wound is closed and dressed as described for hydrocoelectomy.





Spermatic  
cord

Cyst

Cyst

Testicle

# Orchiectomy

- An orchiectomy is the removal of the testis or testes.
- Removal of both testes is castration and renders the patient sterile and deficient in the hormone testosterone, which is responsible for development of secondary sexual characteristics and potency.

# Orchiectomy indications

- Bilateral orchiectomy
  - usually performed to control symptomatic metastatic carcinoma of the prostate gland.
- Unilateral orchiectomy is indicated because of testicular cancer, trauma, or infection.
- Two approaches
  - Inguinal
  - Scrotal

# Orchiectomy: operative technique

## SCROTAL APPROACH

1. For benign conditions the incision is made over the anterolateral surface of the midportion of the scrotum.
2. The surgeon carries the skin incision through the subcutaneous and fascial layers through the tunica vaginalis, exposing the testicle.
3. Retractors are placed, and bleeding vessels are clamped and ligated.
4. The spermatic cord is divided into two or three vascular bundles. Each vascular bundle is doubly clamped, cut, and ligated, first with 0 absorbable suture ligature and then with a proximal free 0 absorbable tie.
5. The vas is separately ligated with a 0 absorbable tie. The testis is removed.
6. The procedure is repeated on the opposite side if bilateral excision is planned.



# Orchiectomy: operative technique

1. For malignant conditions the incision is begun just above the internal ring, extending downward and inward over the inguinal canal to the external inguinal ring.
2. The surgeon exposes the inguinal canal and dissects the spermatic cord free, cross-clamps it, and divides it into vascular bundles at the internal ring.
3. Gentle forward traction is applied to the cord, which is dissected from its bed.
4. The testis is everted into the wound from the scrotum and excised.
5. The procedure is repeated on the opposite side if bilateral excision is planned.
6. Bleeding is controlled with electrocoagulation. A small drain may be placed in the empty hemiscrotum if desired.
7. The surgeon reapproximates the external oblique fascia with 2-0 absorbable interrupted sutures.
8. Subcutaneous tissue, including Scarpa's fascia, is closed with 4-0 absorbable sutures.
9. The skin is reapproximated with surgical staples or 4-0 subcuticular sutures.



Thank  
you



Instagram: [dr.farshad.gholipour](https://www.instagram.com/dr.farshad.gholipour)