AL-Mustaqbal university
College of Sciences
Department of Medical Biotechnology
Histology /2rd Stage
Lecture 8
Dr. Sarah Kamil

The Urinary System

Introduction:
The urinary organs are:
A pair of kidneys;
A pair of ureters;
The urinary bladder;
The urethra.

Urine production, and the control of its composition, is exclusively the function of the kidneys. The urinary bladder is responsible for storage of urine until it is voided. The ureter and urethra are simple passages for transport of urine.

The kidney

Each kidney has a characteristic bean-like shape. A thin layer of fibrous tissue, which constitutes the capsule, intimately covers kidney tissue. The capsule of a healthy kidney can be easily stripped off, but it becomes adherent in some diseases. The kidney has a convex lateral margin; and a concavity on the medial side that is called the hilum. The hilum leads into a space called the renal sinus. The renal sinus is occupied by the upper expanded part of the ureter called the renal pelvis. Within the renal sinus the pelvis divides into two (or three) parts called major calyces. Each major calyx divides into a number of minor calyces (Fig. 1). The end of each minor calyx is shaped like a cup. A projection of kidney tissue, called a papilla fits into the cup. Kidney tissue consists of an outer part called the cortex, and an inner part called the medulla.

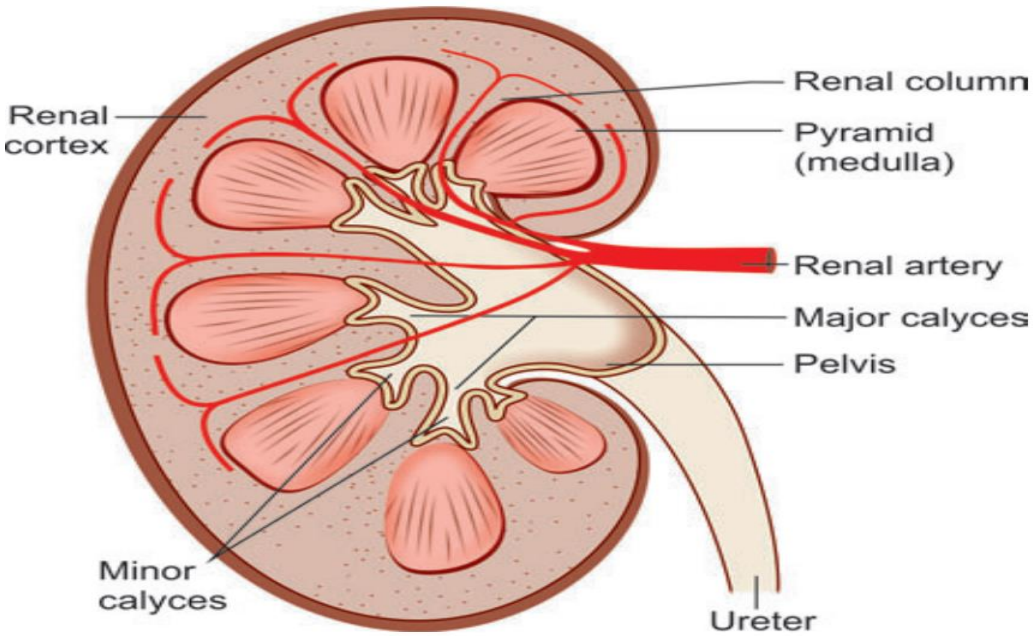

Figure 1: Some features to be seen in a coronal section through the kidney

Medulla

The medulla is made up of triangular areas of renal tissue that are called the renal pyramids. Each pyramid has a base directed towards the cortex; and an apex (or papilla) that is directed towards the renal pelvis, and fits into a minor calyx. Pyramids show striations that pass radially towards the apex.

Cortex

The renal cortex consists of the following: ‰

Tissue lying between the bases of the pyramids and the surface of the kidney, forming the cortical arches or cortical lobules. This part of the cortex shows light and dark striations. The light lines are called medullary rays.

Tissue lying between adjacent pyramids is also a part of the cortex. This part constitutes the renal columns. ‰

In this way each pyramid comes to be surrounded by a ‘shell’ of cortex. The pyramid and the cortex around it constitute a lobe of the kidney. This lobulation is obvious in the fetal kidney

Nephron

Nephron is the structural and functional unit of kidney and there are about 1–4 million nephrons in each kidney. The nephron consists of a renal corpuscle (or Malpighian corpuscle), and a long complicated renal tubule

Renal tubule is made up of three parts: %‰
- The proximal convoluted tubule, %‰
- Loop of Henle, %‰
- The distal convoluted tubule (Fig. 2).

Renal corpuscle is situated in the cortex of the kidney either near the periphery or near the medulla. Based on the situation of renal corpuscle, the nephrons are classified into two types: %‰

- Cortical nephrons or superficial nephrons (which have their corpuscles in the outer cortex). %‰
- Juxtamedullary nephrons (which have their corpuscles in the inner cortex near medulla or corticomedullary junction).

Renal corpuscles, and (the greater parts of) the proximal and distal convoluted tubules are located in the cortex of the kidney. The loops of Henle and the collecting ducts lie in the medullary rays and in the substance of the pyramids.

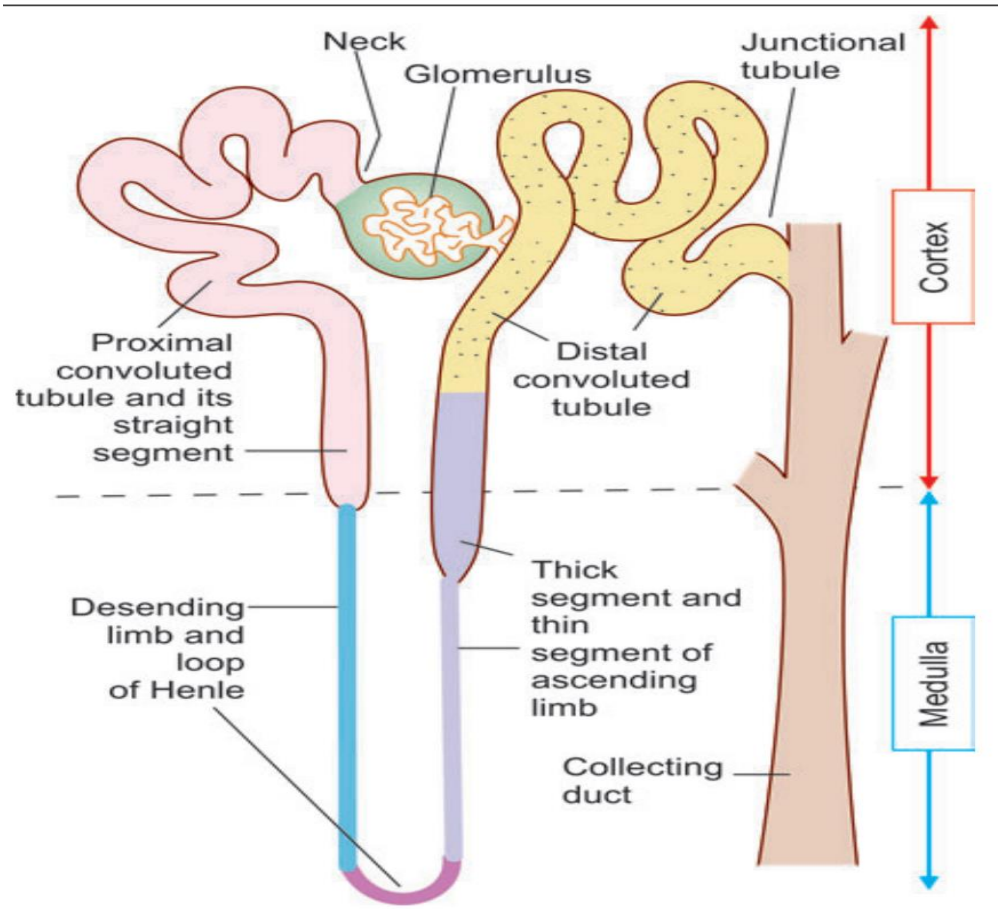

Figure 2. Parts of a nephron. A collecting duct is also shown

The ureters

Ureters are muscular tubes that conduct urine from renal pelvis to the urinary bladder. **The wall of the ureter has three layers:** %‰

An inner lining of mucous membrane, %‰

A middle layer of smooth muscle, %‰

An outer fibrous coat: adventitia (Fig. 3).

Mucous Membrane: The mucous membrane has a lining of transitional epithelium that is 4 to 5 cells thick and an underlying connective tissue, lamina propria. The mucosa shows a number of longitudinal folds that give the lumen a star-shaped appearance in transverse section. The folds disappear when the ureter is distended.

Muscle Coat: The muscle coat is usually described as having an inner longitudinal layer and an outer circular layer of smooth muscle. A third layer of longitudinal fibres is present outside the circular coat in the middle and lower parts of the ureter. The layers are not distinctly marked off from each other. Some workers have reported that the musculature of the ureter is really in the form of a meshwork formed by branching and anastomosing bundles of muscle fibres.

Adventitia: Adventitia is the outer fibrous coat consisting of loose connective tissue. It contains numerous blood vessels, nerves, lymphatics and some fat cells.

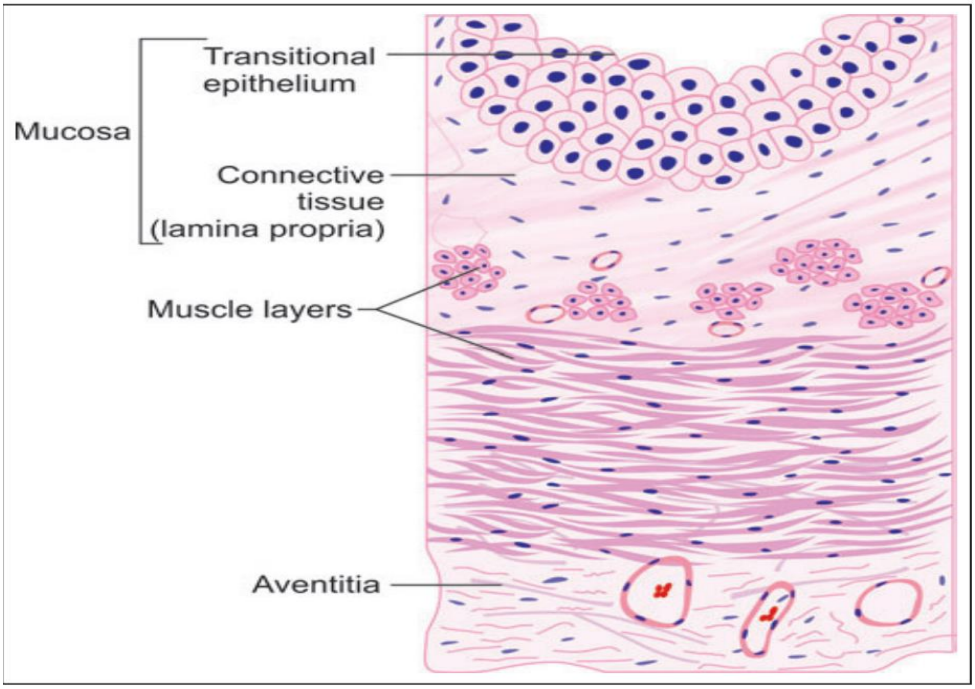

Figure 3: Layers of ureter

The urinary bladder

Urinary bladder is a muscular bag, where urine is stored temporarily and is discharged periodically via urethra during micturition. The wall of the urinary bladder **consists of three layers**: ‰‰
An inner mucous membrane, ‰‰
A thick coat of smooth muscle,
An outer serous layer (fig.4).

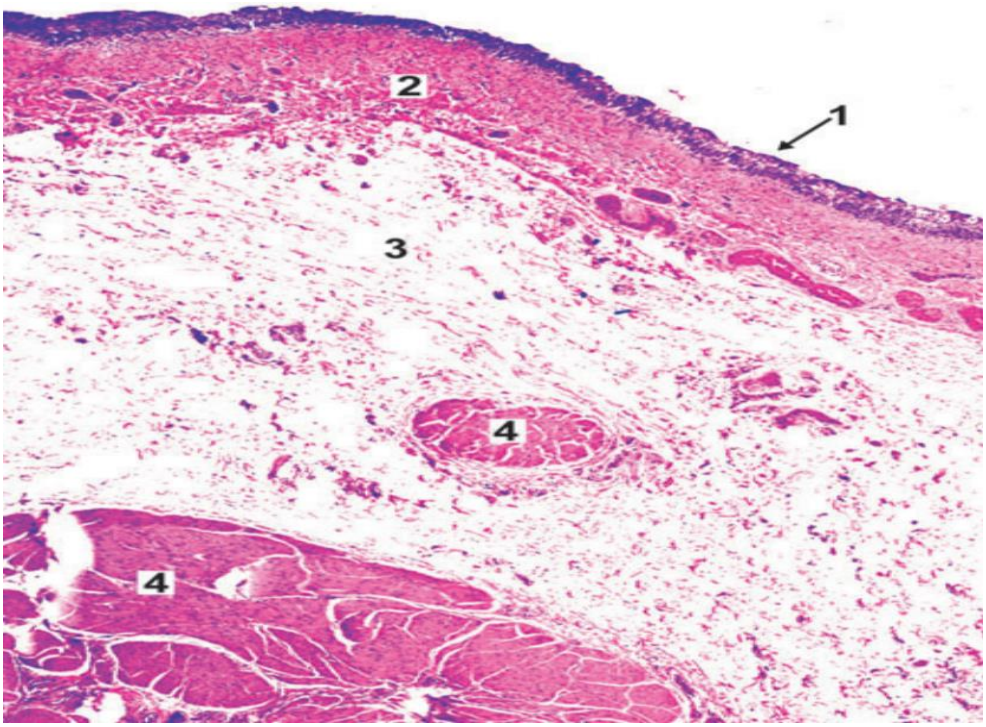

Figure 4: Urinary bladder. 1. Transitional epithelium 2. Lamina propria 3. Interstitial connective tissue 4. Smooth muscle bundles 5. Serous layer.

Mucous Membrane

The mucous membrane is lined by transitional epithelium. There is no muscularis mucosae. In the empty bladder the mucous membrane is thrown into numerous folds that disappear when the bladder is distended. Some mucous glands may be present in the mucosa specially near the internal urethral orifice. When the bladder is distended (with urine) the lining epithelium becomes thinner. This results from the ability of the epithelial cells to change shape and shift over one another.
Note: The transitional epithelium lining the urinary bladder (and the rest of the urinary passages) is capable of withstanding osmotic changes caused by variations in concentrations of urine. It is also resistant to toxic substances present in urine.

Muscle Coat

The muscle layer is thick. The smooth muscle in it forms a meshwork. Internally and externally the fibres tend to be longitudinal. In between them there is a thicker layer of circular (or oblique) fibres. Contraction of this muscle coat is responsible for emptying of the bladder. That is why it is called the **detrusor muscle**. Just above the junction of the bladder with the urethra the circular fibres are thickened to form the **sphincter vesicae**.

Serous layer

The superior surface of the bladder is covered by mesothelium of peritoneum, forming serous layer. The inferior part of the bladder is covered with adventitia which is made of fibroelastic connective tissue carrying blood vessels, nerves and lymphatics.