SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai

DEPARTMENT OF CARDIOPULMONARY PERFUSION CARE TECHNOLOGY

COURSE NAME: PATHOLOGY II

II YEAR

UNIT III : PATHOLOGY OF KIDNEY

TOPIC 1 : KIDNEY FUNCTION TEST

Anatomy of Kidney

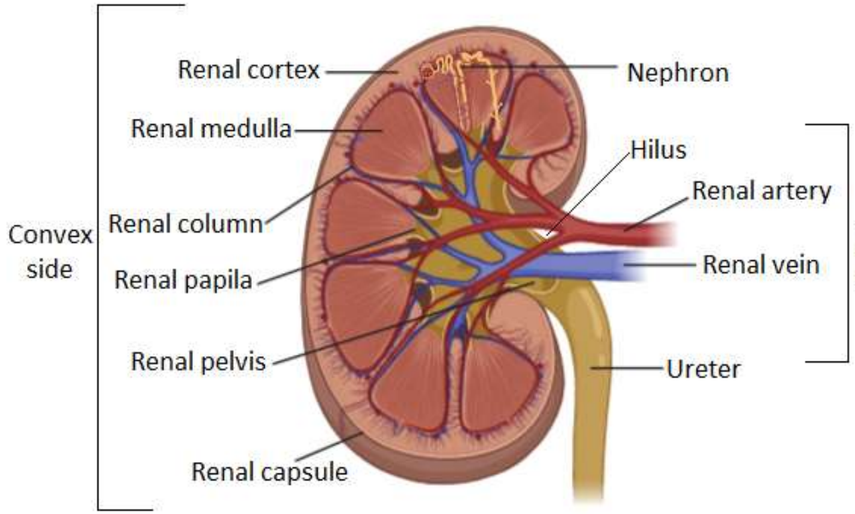
- The kidneys are *bean-shaped paired organs*
- Each weighing about 150 gm in the adult male and about 135 gm in the adult female.
- *Hilum* – where artery, vein, lymphatics and ureter are located

Three main structure of kidneys

renal cortex **-** outer rim of kidney, contains nephron (glomeruli and tubules)

renal medulla **-** (inner region) 8-18 cone-shaped renal pyramids – for passage of urine

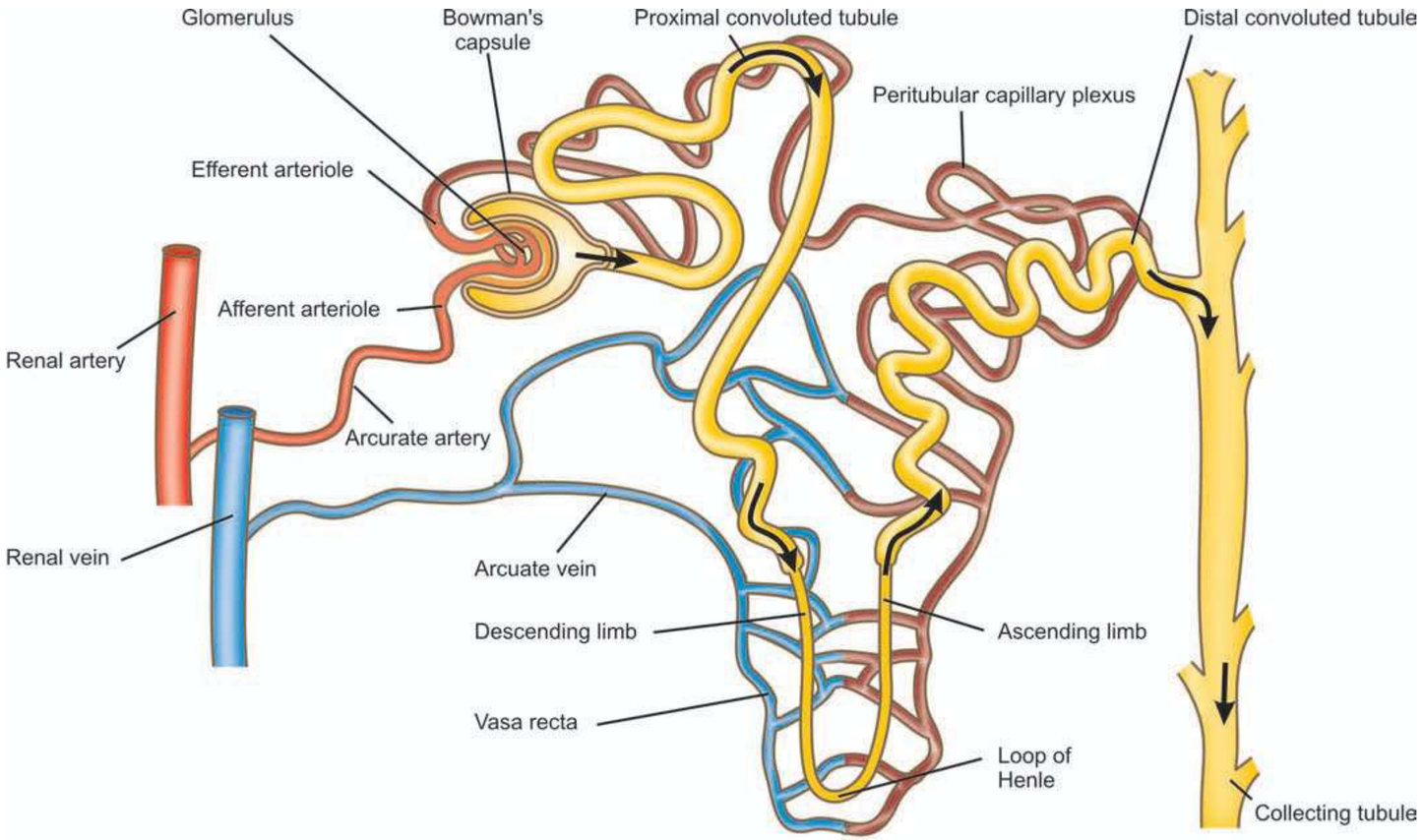
renal pelvis **-** funnel-shaped collection area of the urine



Internal structure of Kidney

Histology of Kidney

- The functional unit of kidney is called as *nephron*
- There are *one million microstructures* present in each kidney



Parts of Nephron

- Glomerular capsule (glomerulus and bowman's capsule)
- The proximal convoluted tubule (PCT)
- The loop of henle
- The distal convoluted tubule (DCT)
- The collecting ducts.

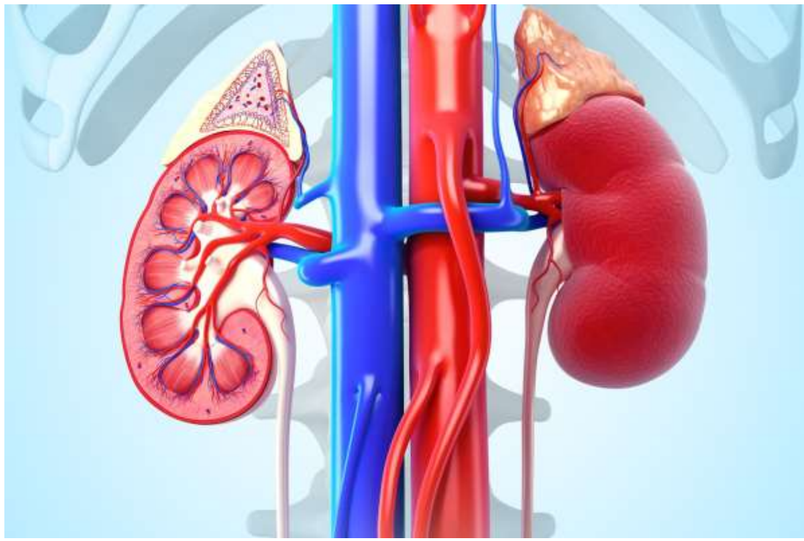
Physiology of Kidney

- *Excretion of waste* products resulting from protein metabolism.

- Regulation of *acid-base balance* by excretion of H+ ions (acidification) and bicarbonate ions.

- *Regulation of salt-water* balance by hormones secreted both intra- and extra-renally

- *Formation of renin and erythropoietin* and thereby playing a role in the regulation of blood pressure and erythropoiesis



Renal Function Test

Urine analysis

- Physical examination
- Chemical constituents
- Bacteriologic examination
- Microscopy

Blood chemistry

- Urea
- Blood urea nitrogen (BUN)
- Creatinine
- β2-microglobulin

Concentration and dilution tests

- Concentration test (fluid deprivation test)
- Dilution test (excess fluid intake test)

Renal clearance tests

- Inulin or mannitol clearance test
- Creatinine clearance
- Urea clearance

Urine Analysis

Physical Examination

- Normally urine is clear, pale or straw-coloured due to pigment urochrome
- 700-2500 ml (average 1200 ml) of urine is passed in 24 hours

Chemical tests

- detect the presence of protein, glucose, red cells and haemoglobin to assess the permeability of glomerular membrane

- *Bacteriologic examination* - midstream specimen of urine.

Urine microscopy

- red cells, pus cells, epithelial cells, crystals and urinary casts

Concentration and dilution tests

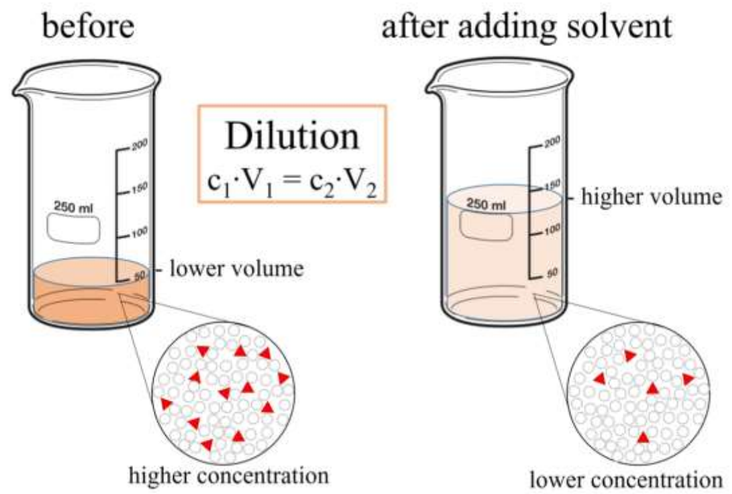
- It is to evaluate *functional capacity of the renal tubules.*

concentration test

- an artificial fluid deprivation is induced in the patient for more than 20 hours
- water is selectively reabsorbed in this patient
- high solute concentration is present

dilution test

- excess of fluid is given to the patient.
- renal compensation should result in excretion of urine with high water content and lower solute concentration



Blood chemistry

- Impairment of renal function results in elevation of end-products of protein metabolism.

The End products are,

- *Urea* (normal range 20-40 mg/dl),
- *Blood Urea nitrogen* (BUN) (normal range 10-20 mg/dl) and
- *Creatinine* (normal range 0.6-1.2 mg/dl). An increase of these

- End-products in the blood is called *azotaemia.*

- High levels of β2-*microglobulin* in the serum as well as urine, a low molecular weight protein filtered excessively in the urine due to glomerular disease

Renal clearance tests

- A clearance test is employed to *assess the rate of glomerular filtration and the renal blood flow.*
- The glomerular filtration rate normal - 120 ml/minute in an average adult

$$C = \frac{uV}{P}$$

- *C* is the clearance of the substance in ml/ minute;
- *U* is the concentration of the substance in the urine;
- *V* is the volume of urine passed per minute; and
- *P* is the concentration of the substance in the plasma.

Renal clearance tests

Inulin or mannitol clearance tests

- An intravenous infusion of the substance inulin or mannitol is given to patient
- Maintain constant plasma concentration and Urine sample collected
- Inulin is filtered from the glomerulus and is excreted unchanged in the urine.

Creatinine clearance test

- Creatinine released into plasma by muscle metabolism
- The clearance of creatinine is determined by collecting urine over 24-hour period and a blood sample is withdrawn during the day.

Urea clearance test

- Urea test is affected by a number of factors (e.g. dietary protein, fluid intake, infection, trauma, surgery, and corticosteroids