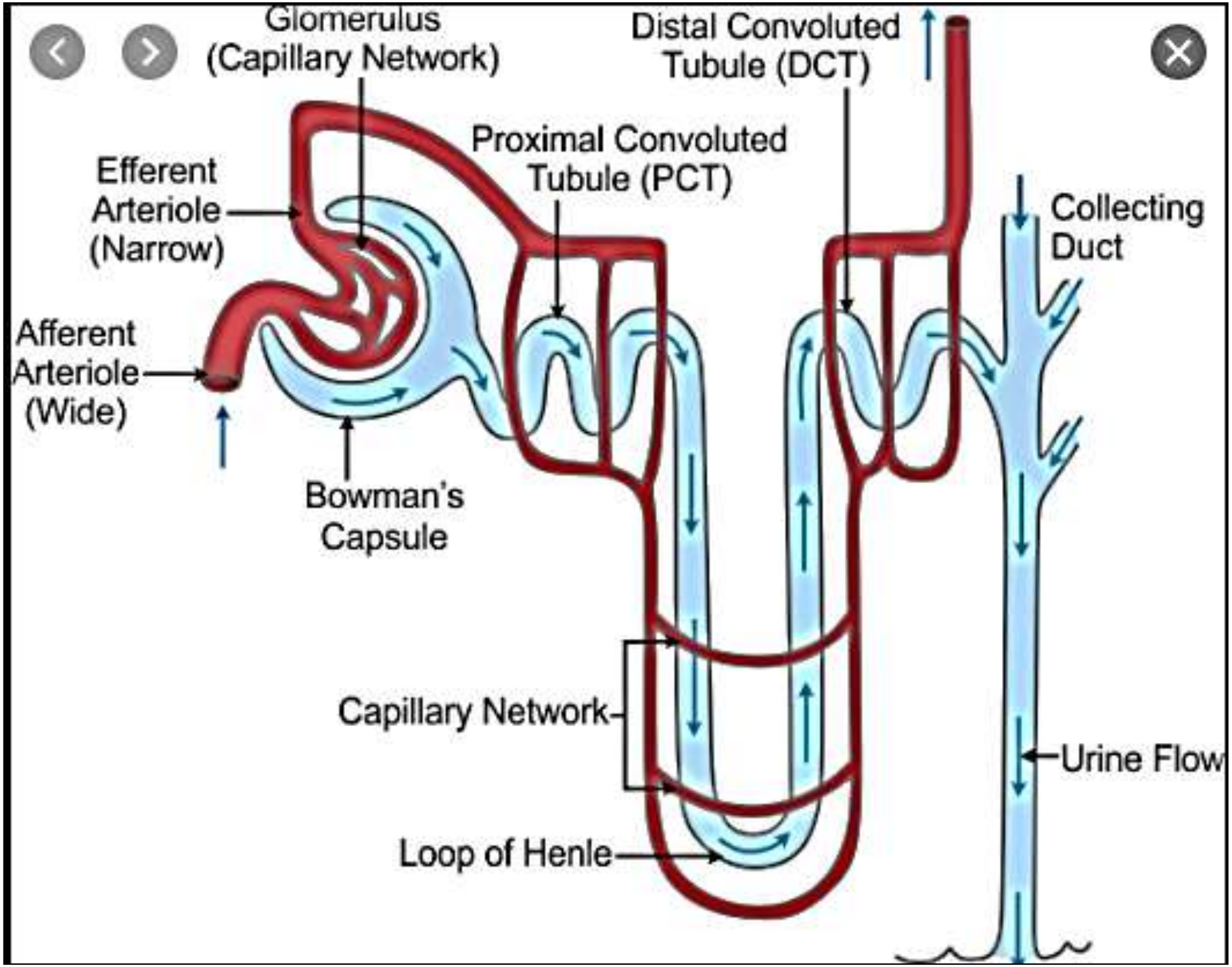
Diseases of Urinary and Male Genital Systems

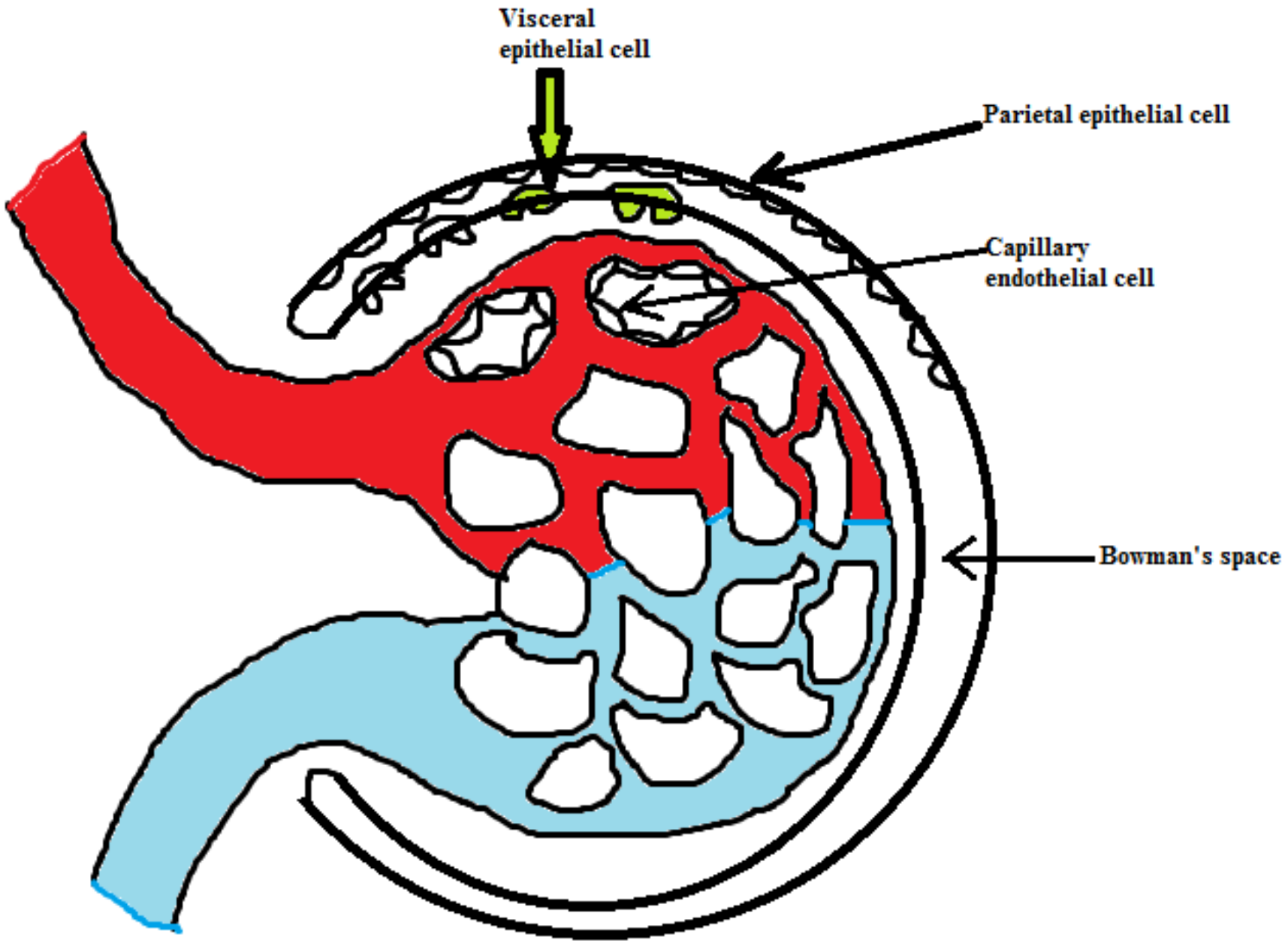
By

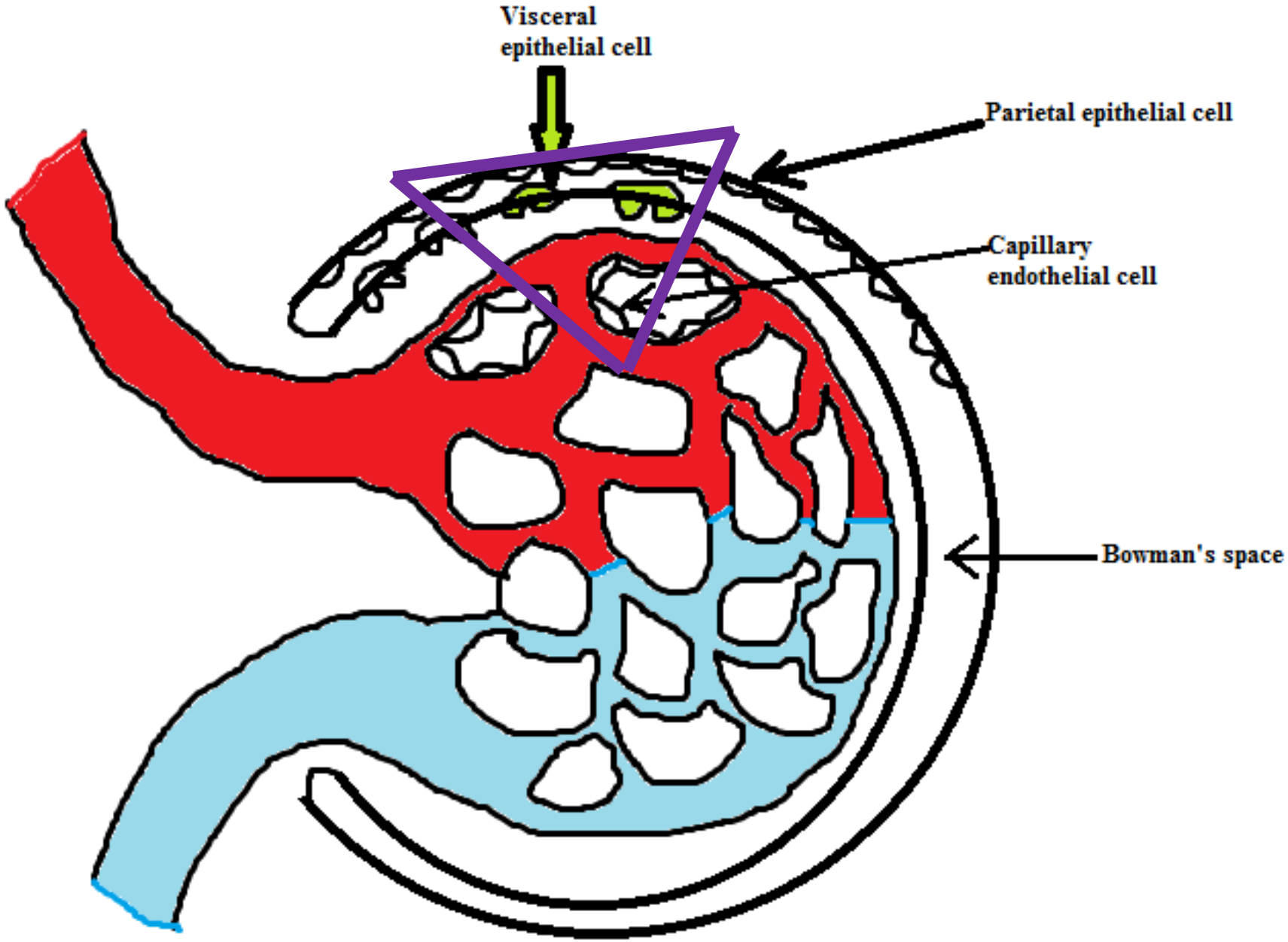
Dr/ Maisa Hashem

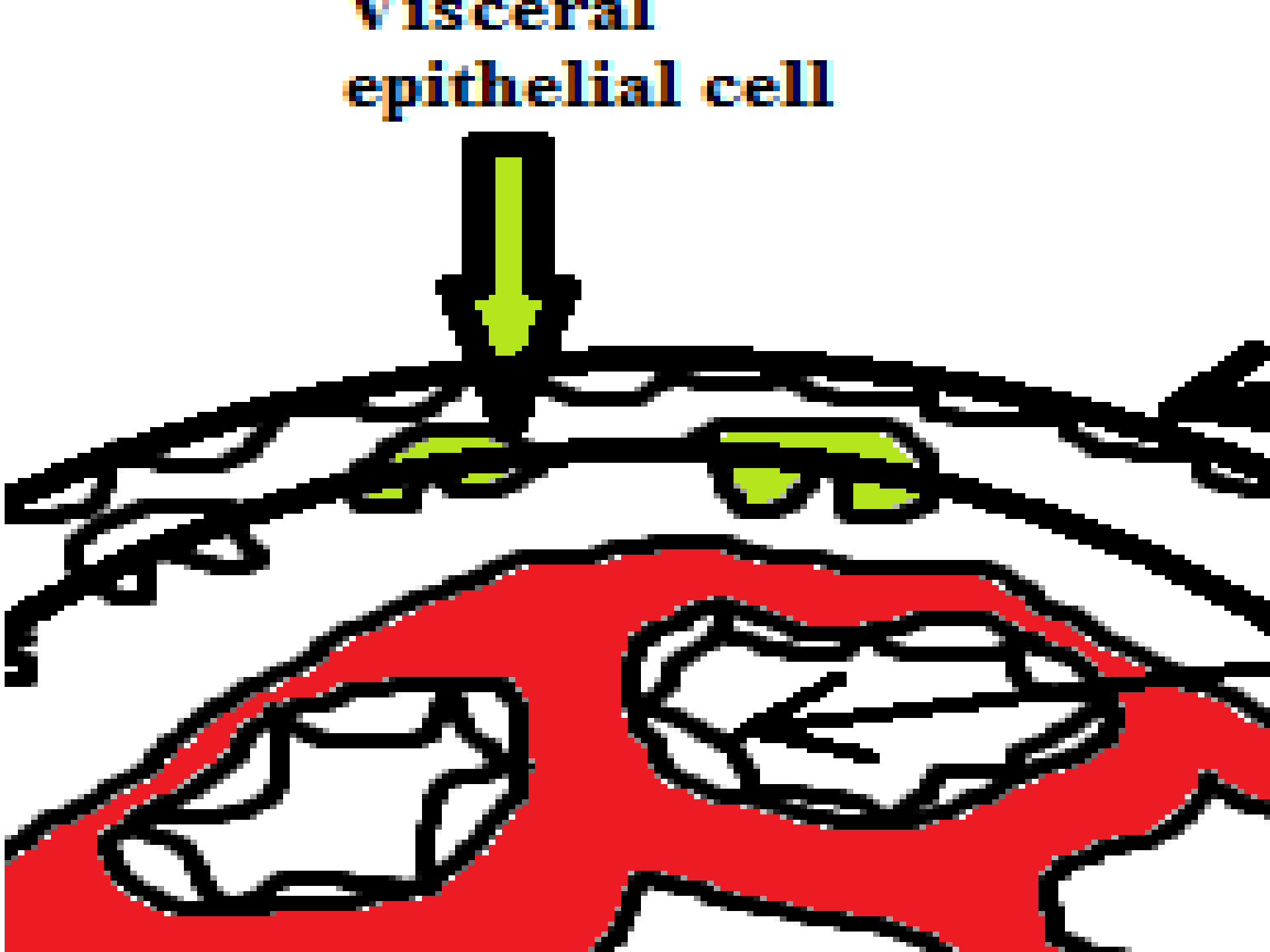
A Lecturer of Pathology

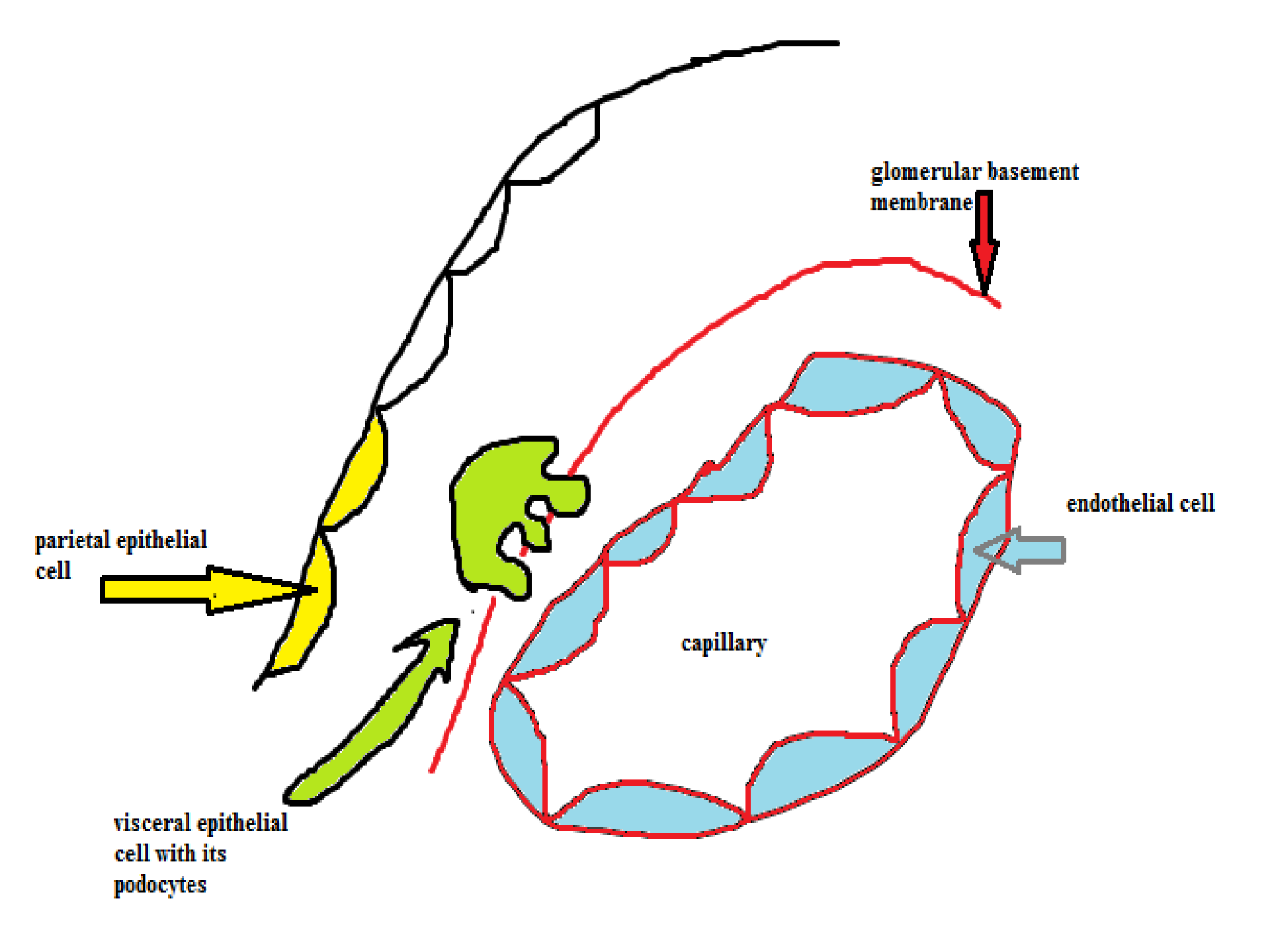
Diseases of the Glomeruli


Glomerulus
(Capillary Network)
Distal Convoluted
Tubule (DCT)
Proximal Convoluted
Tubule (PCT)
Efferent
Arteriole
(Narrow)
Collecting
Duct
Afferent
Arteriole
(Wide)
Bowman's
Capsule
Capillary Network
Urine Flow
Loop of Henle


Visceral
epithelial cell
Parietal epithelial cell
Capillary
endothelial cell
Bowman's space


Visceral
epithelial cell
Parietal epithelial cell
Capillary
endothelial cell
Bowman's space


Visceral
epithelial cell


glomerular basement membrane
endothelial cell
parietal epithelial cell
capillary
visceral epithelial cell with its podocytes

Glomerular diseases are classified into:

Primary glomerulonephritis: The kidney is the primary target of the disease. The injury is usually due to immunological mechanism.

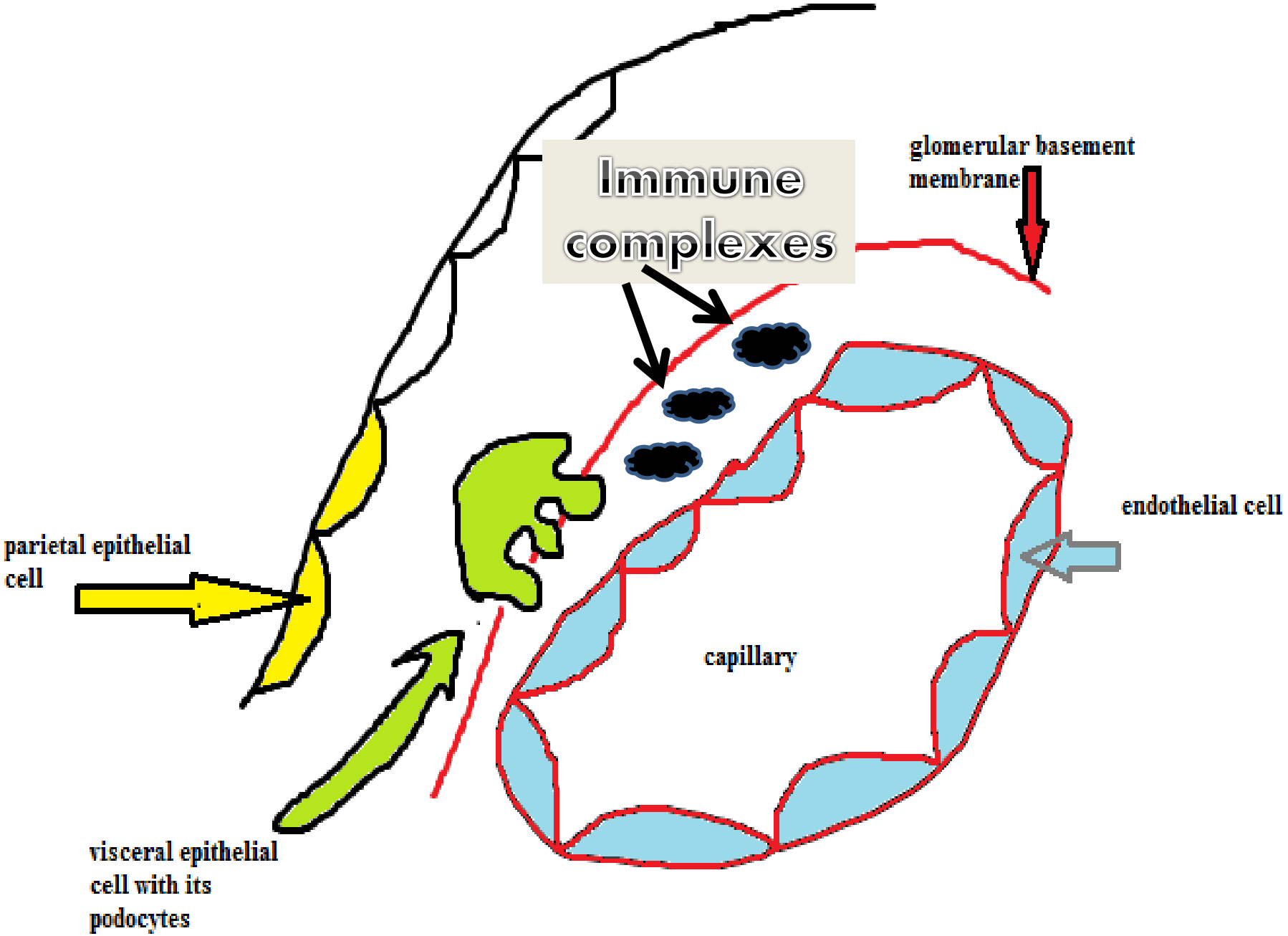
Secondary glomerulonephritis: glomerular diseases secondary to;

- Vascular diseases as hypertension.
- Metabolic diseases as diabetes mellitus.
- Immunological diseases as systemic lupus erythematosis.

Acute diffuse proliferative glomerulonephritis/ post streptococcal glomerulonephritis.

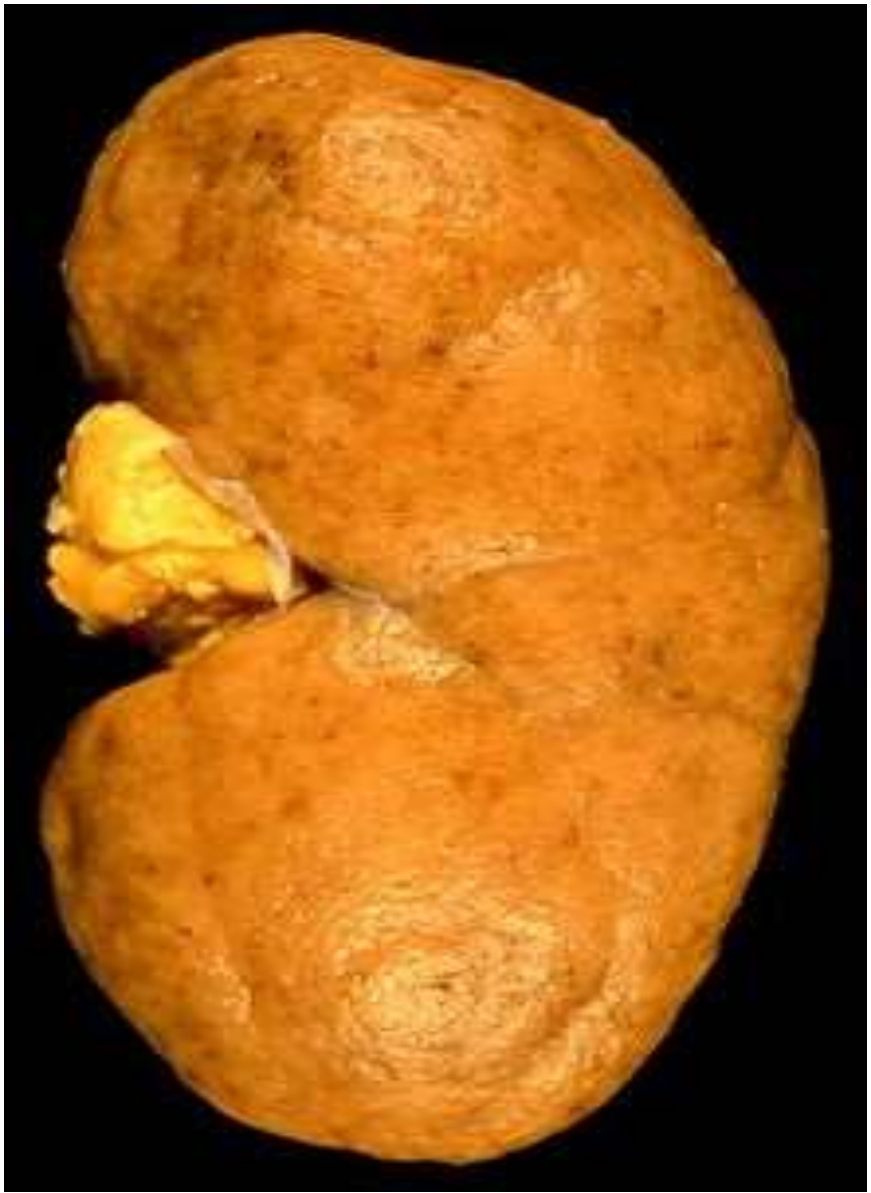
Aetiology:

- A fairly common auto-immune disease in children and young adults. The disease may follow acute tonsillitis, pharyngitis or rarely skin infection.
- It is caused by nephrogenic strains of group A beta haemolytic streptococci after a latent period of 1-4 weeks.
- During the latent period; antibodies mainly IgG are formed against streptococcal antigens.. an immune-complex reaction occurs between streptococcal antigens and the antibodies in patient's serum. The immune-complexes deposit between the epithelial cells and glomerular basement membrane followed by complement activation and inflammatory injury to the glomerular capillaries.


Immune complexes
glomerular basement membrane
parietal epithelial cell
endothelial cell
capillary
visceral epithelial cell with its podocytes

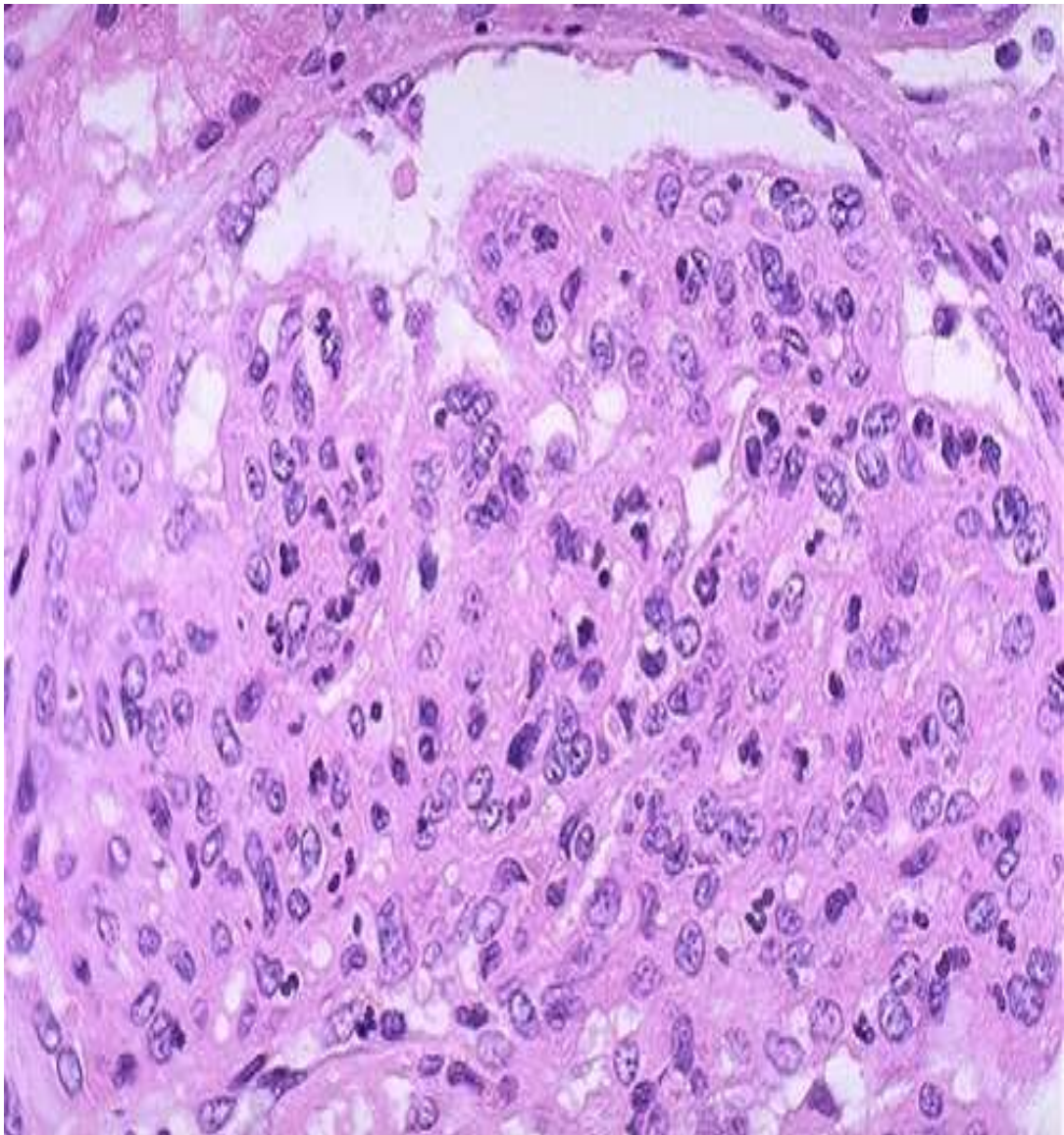
Gross picture

- Both kidneys are slightly enlarged, the capsule strips easily.
- The kidney surface is smooth. Cut section is pale due to oedema.
- In severe cases, there is red spots due to due to capsular haemorrhage.

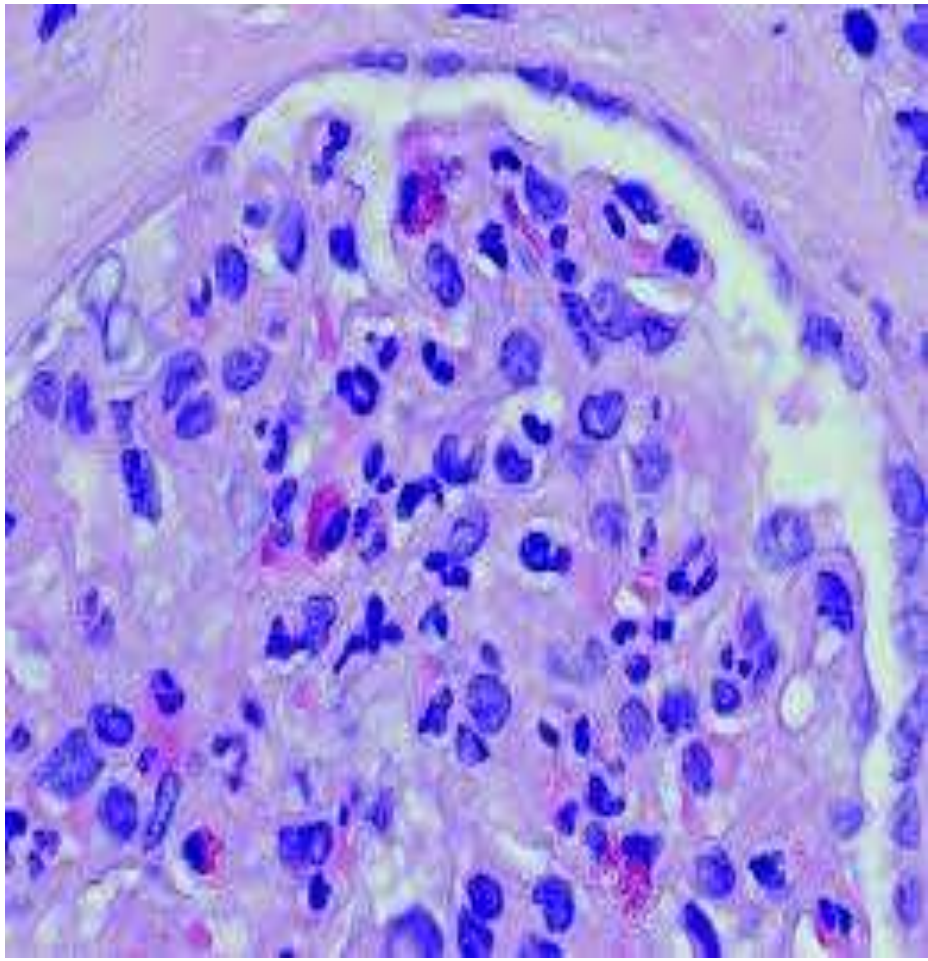


Microscopic picture

- All glomeruli show swollen, cellular, bloodless capillary tufts filling the capsular spaces. The increased cellularity is due to proliferation of capillary endothelium, glomerular epithelium, mesangial cells and infiltration by neutrophils and monocytes.
- The capsular space is narrowed and contains coagulated albumin, fibrin threads, neutrophils, RBCs and desquamated epithelial cells.



- The convoluted tubules shows cloudy swelling, hydropic and fatty changes.
- The collecting tubules contain casts especially blood casts.
- The interstitial tissue is hyperaemic, oedematous and shows neutrophilic infiltrate.



General features

- Fever and malaise.
- **Nephritic oedema:** peri-orbital oedema which is marked in the morning. The oedema may involve the rest of the face and may become generalized.
- **Hypertension:** mild to moderate degree. Both hypertension and oedema are due to salt and water retention.
- **Blood changes:** elevation of blood urea and creatinine, normocytic normochromic anaemia.

- **Urine changes**:
- The urine is brownish and turbid (turbid or Coca-Cola like) due to presence of altered red cells.
- Oliguria, moderate proteinuria and increased specific gravity up to 1035.
- Microscopically; the sediment contains red cells, neutrophils, hyaline, granular, cellular and blood casts.
- ***Haematuria, proteinuria, hypertension, oedema, oliguria and uraemia constitute acute nephrtic syndrome.***

Course

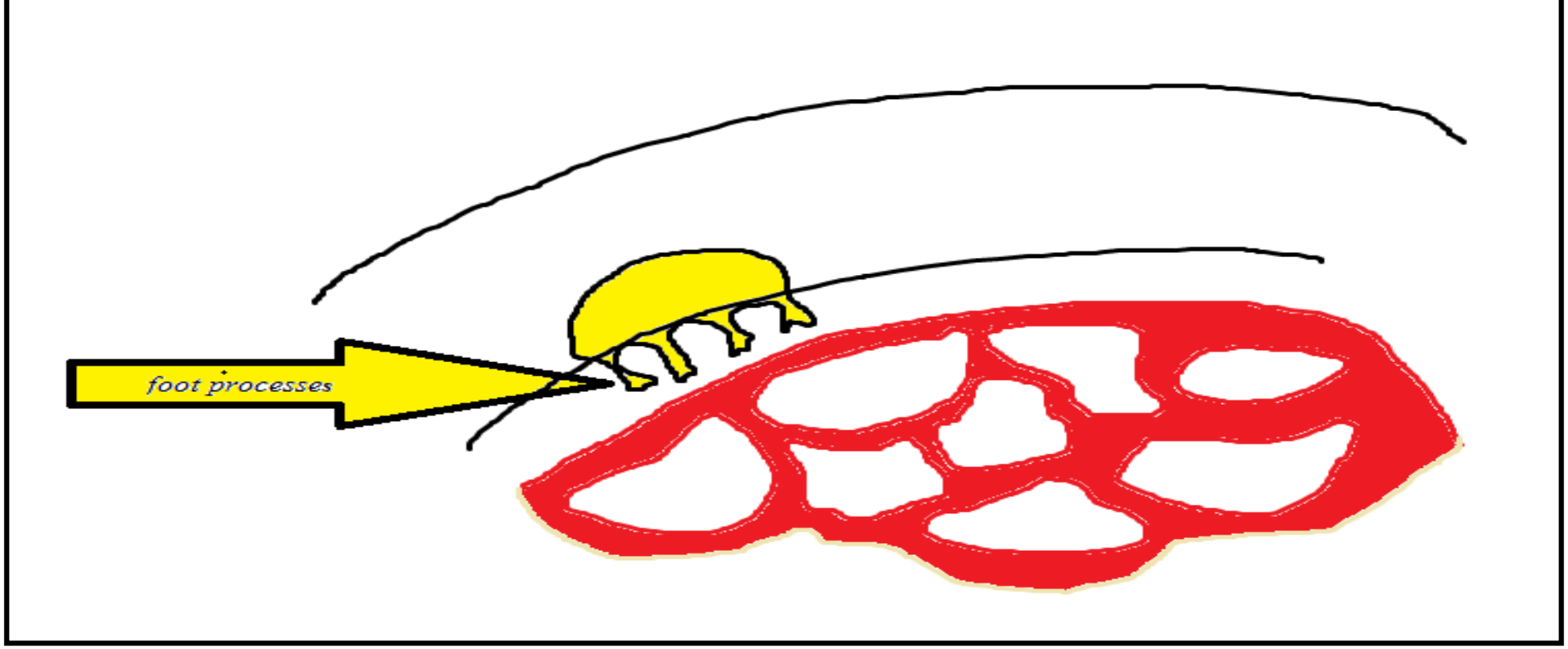
- Complete recovery in over 95% of children and 65% of adults.
- The disease may progress to rapidly progressive or chronic glomerulonephritis.
- Death from acute uraemia or acute heart failure caused by sever hypertension.

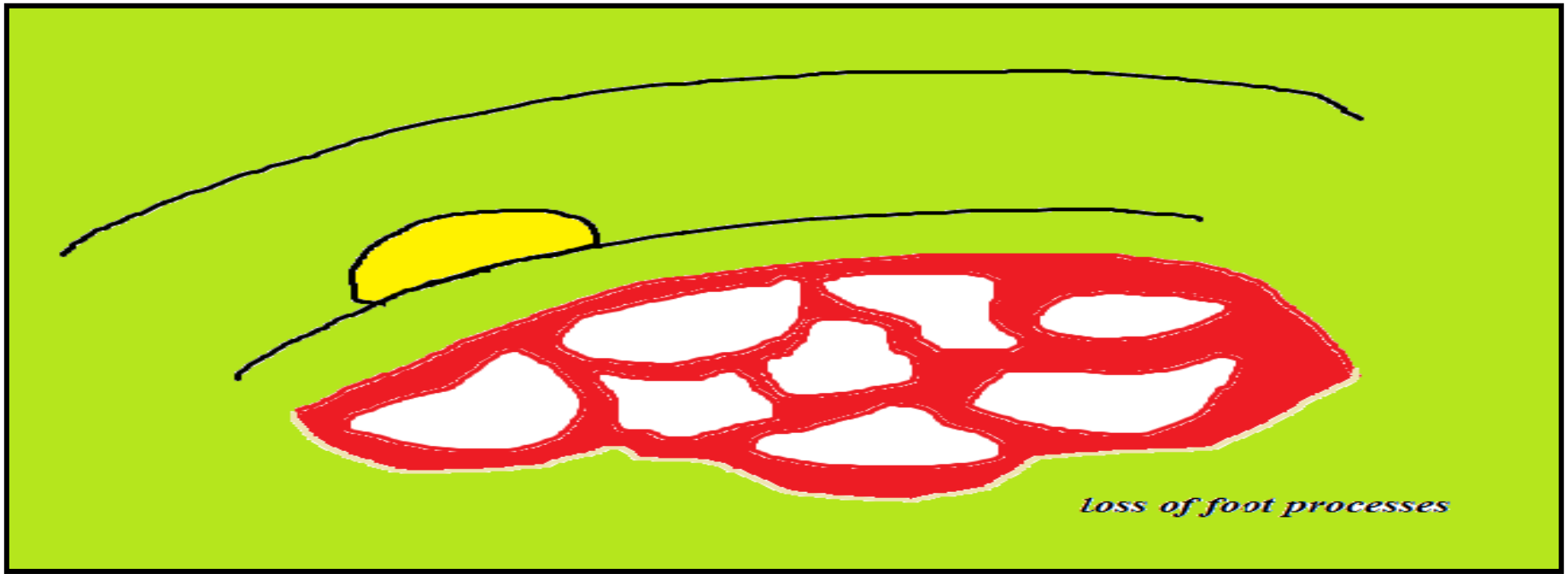
Minimal change glomerulonephritis/ lipoid disease/ light negative GN/ Foot process disease.

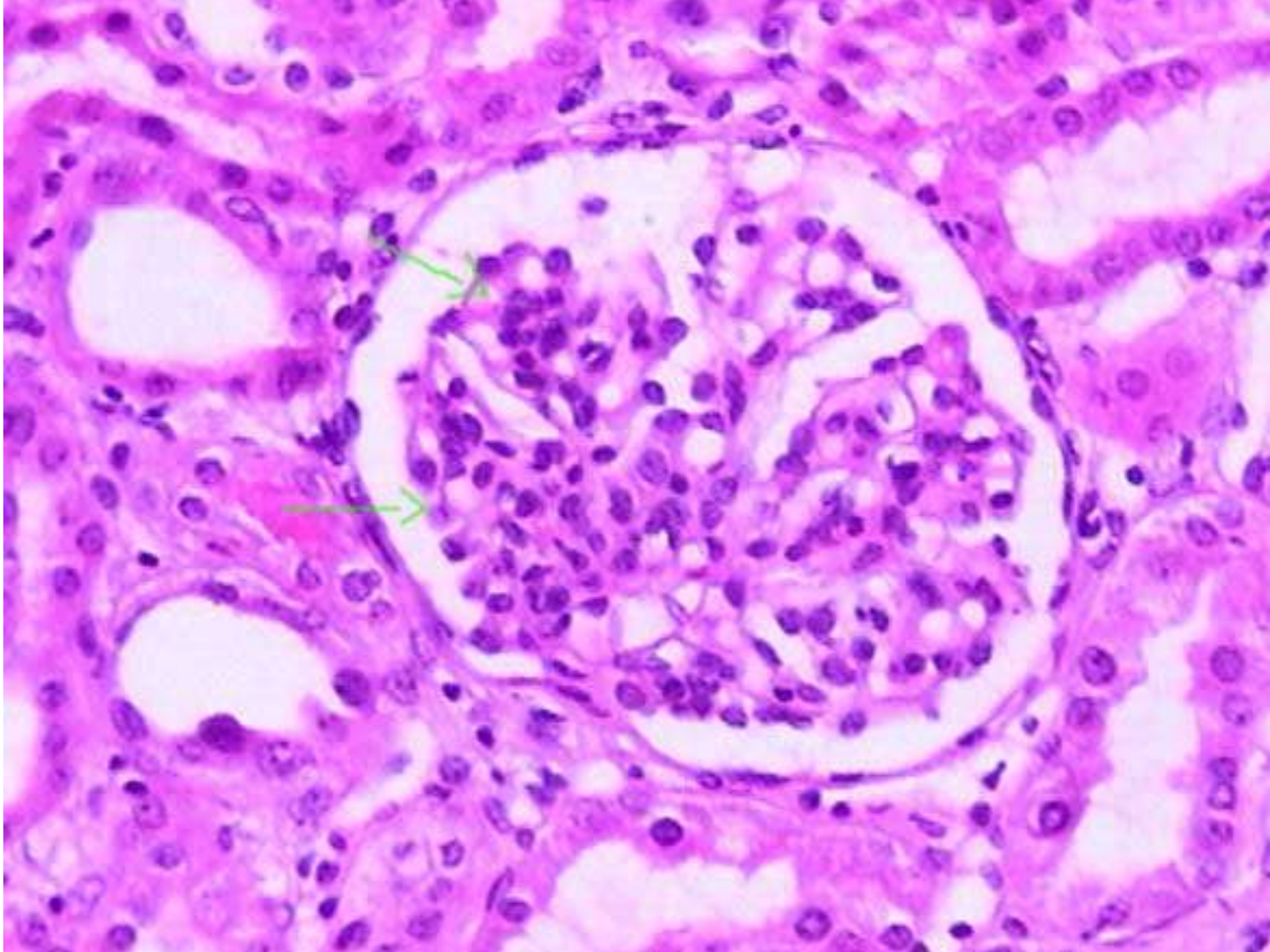
It is a disease of small children (2-6 years), but may occur in older children and adults. The exact aetiology is unknown but the disease may follow respiratory infection. This disease is the commonest cause of nephrotic syndrome in children.

Pathological features

- The kidneys don't show any gross abnormalities.
- **By light microscope;** the glomeruli show no pathological changes. However, the proximal convoluted tubules show lipid deposition in the lining cells. this lipid reflects glomerular leakage and reabsorption of lipoproteins.
- **By electron microscopy;** diffuse loss of foot processes of the visceral epithelial cells.
- Most cases cure with corticosteroid therapy.


foot processes


loss of foot processes



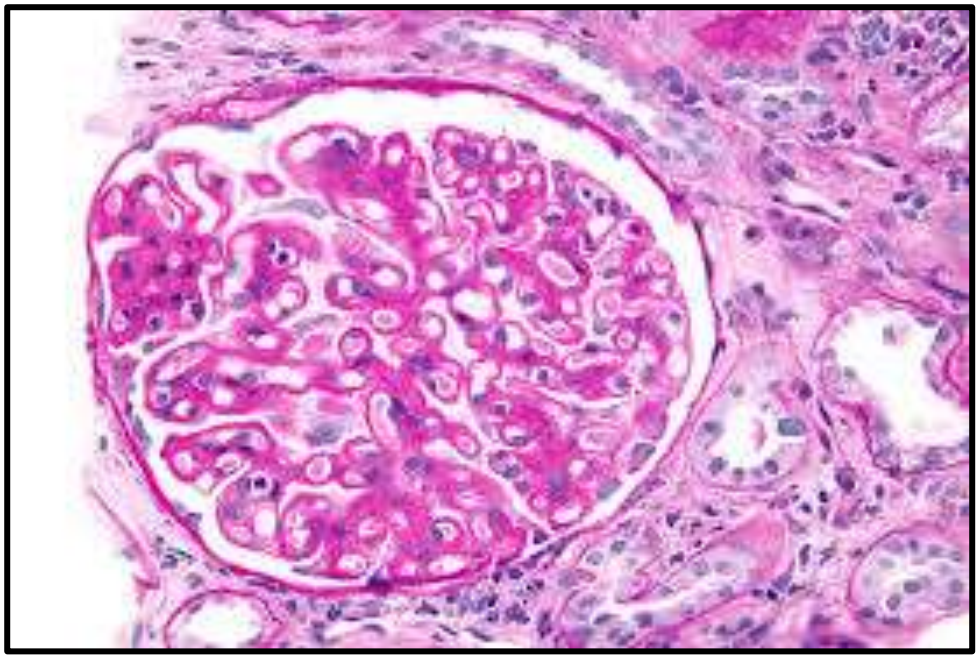
Membranous glomerulonephritis

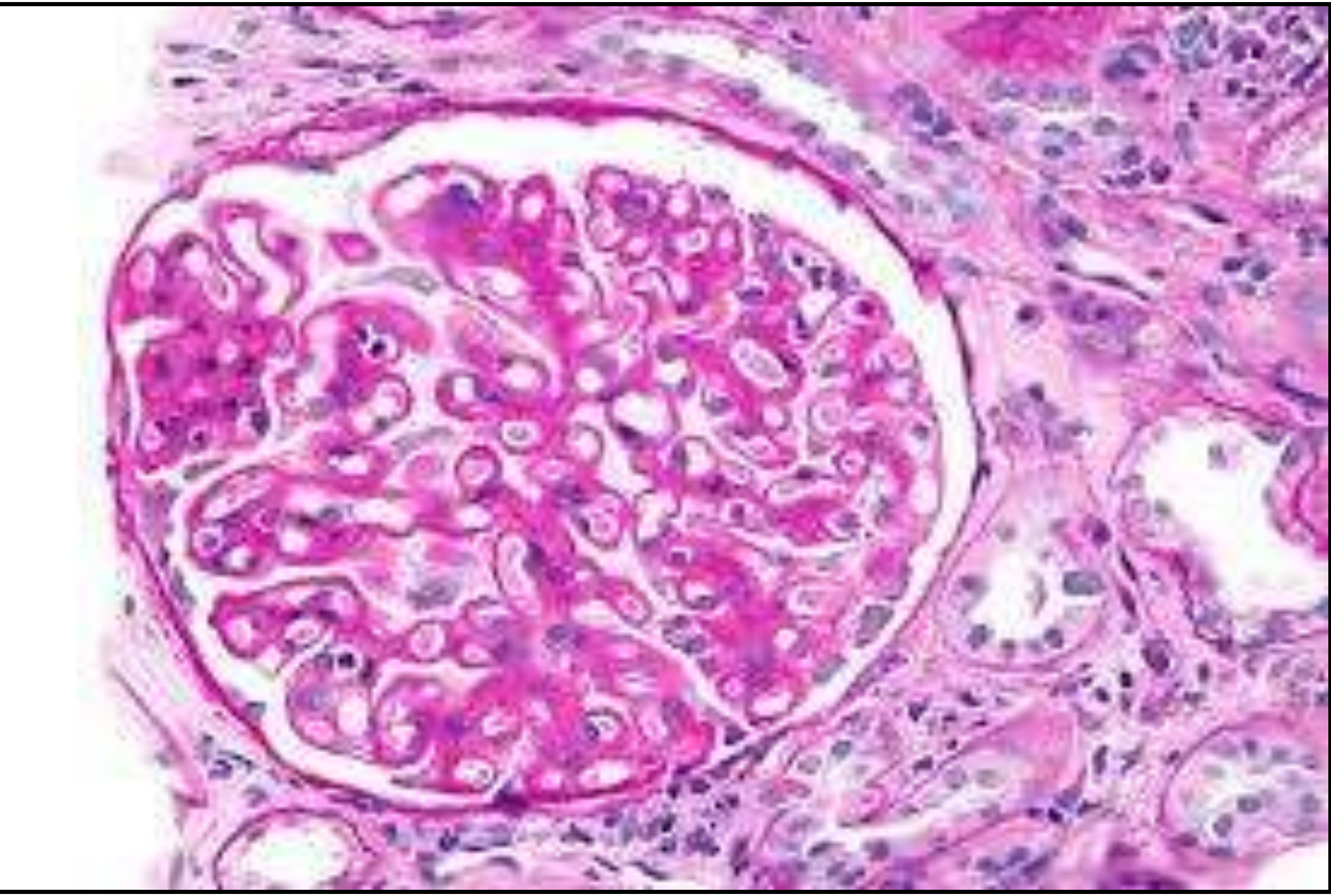
Aetiology:

- Idiopathic in 85% of cases.
- May occur in association with:
  - Systemic lupus erythematosis.
  - Infections as hepatitis B, bilharziasi, malaria, syphilis.
  - Metabolic diseases as diabetes mellitus.
  - Malignant epithelial tumors as carcinoma of lung, carcinoma of colon.

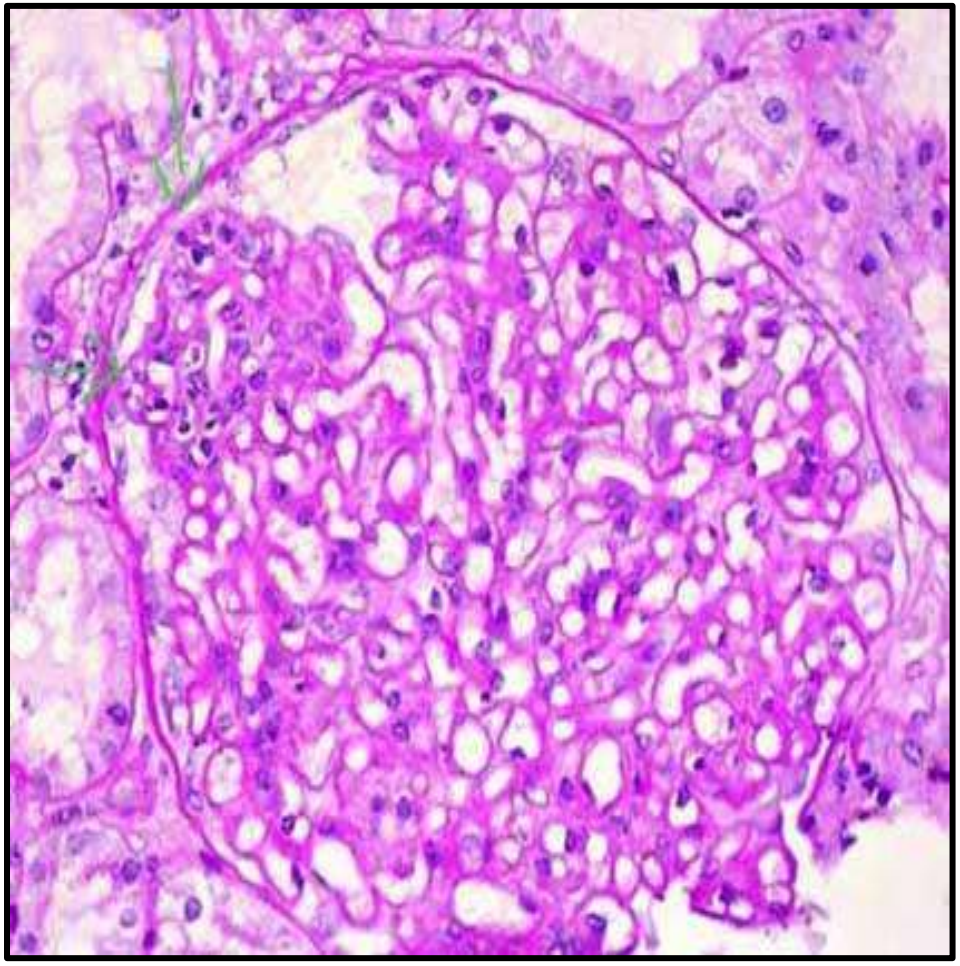
Pathological features

- The kidneys are enlarged and pale.
- **Light microscopy:** diffuse thickening of the glomerular basement membrane easily demonstrated by PAS stain. No cellular proliferation of the glomeruli.
- **Electron microscopy:** the epithelial cells are swollen and loss their foot processes, dense IgG deposited between basement membrane and overlying epithelial cells.





- In advanced cases, glomerular sclerosis and hyalinosis occur, atrophy of tubules and interstitial fibrosis.
- Patients suffer from nephrotic syndrome. In advanced cases, renal insufficiency and hypertension develop.



Nephrotic syndrome

Definition: A group of renal glomerular diseases ; all are characterized by massive proteinuria, hypoalbuminaemia, generalized oedema and hyperlipidaemia.

- **Massive proteinuria:** daily loss of 3-5 gm/24 hours caused by increased permeability of the glomerular capillary tufts to protein.
- **Hypoalbuminaemia:** plasma albumin levels are less than 3 gm/ dl.
- **Generalized oedema:** is caused by 1) hypoproteinaemia with decrease in plasma osmotic pressure. 2) hypoalbuminaemia causing decrease in plasma volume due to loss of osmotic effect. This results in increased aldosterone release leading to sodium and water retention.
- **Hyperlipidaemia:** the exact cause is not compeletly understood, it may be due to protein loss.

Causes of Nephrotic Syndrome

1- Primary glomerular diseases:

- Membranous glomerulonephritis.
- Minimal change glomerulonephritis.
- Membranoproliferative glomerulonephritis.
- Focal proliferative glomerulonephritis.
- Focal segmental glomerulosclerosis.

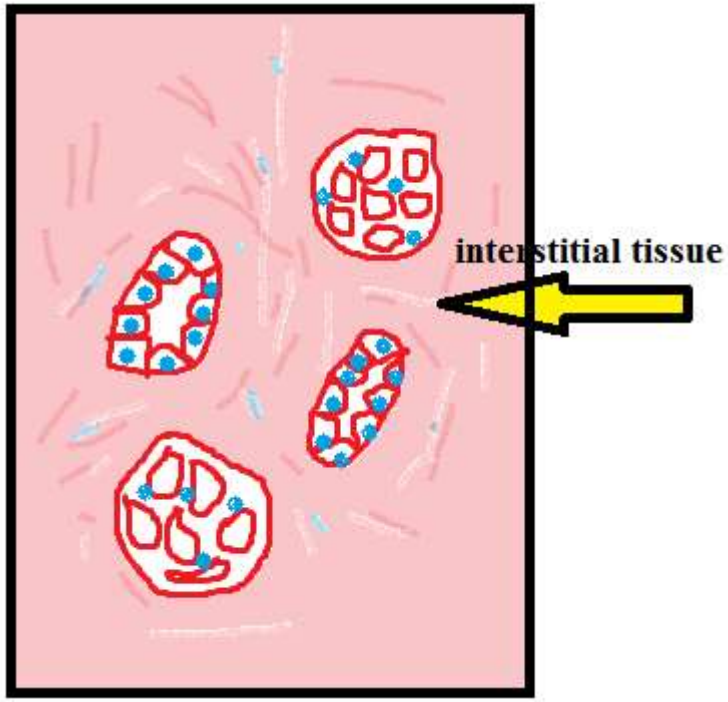
2- Systemic diseases:

- Diabetes mellitus.
- Amyloidosis.
- Systemic lupus erythematosis.
- Infections as HBV, Malaria.
- Malignancy.

Pyelonephritis

Pyelonephritis

Definition: bacterial inflammation of the interstitial tissues of the renal pelvis, medulla and cortex. Pyelonephritis is a very common kidney disease.



Aetiology:

- **Causative organisms:** E. Coli is the commonest causative organism. Others as staph.aureus, strept. Foecalis, bacillus proteus and typhoid bacilli, mixed infection is common.

- **Predisposing factors:**

1. Urinary tract obstruction: causes stasis of urine, facilitating infection. Obstruction is caused by urinary bilharziasis, stricture, stones, tumors, enlarged prostate.
2. Diabetes Mellitus
3. Instrumentation of the urinary tract.
4. Pyelonephritis is more common in females due to short wide female urethra and pressure of the enlarged pregnant uterus on the ureters at the pelvic prim.

- **Routes of infection:**
  - **Haematogenous infection:** occur in most cases. Bacteria enter the blood from septic focus as tonsillitis, sinusitis, otitis media, bronchiectasis,…. .
  - **Ascending infection:** from the bladder by the following routes

1. The lumen of the ureter.
2. Through periureteric lymphatics.

Pathology

I- Acute pyelonephritis:

Grossly: commonly the lesion is bilateral, the kidney is enlarged and congested. The capsule strips easily. The outer surface shows multiple, tiny abscesses. Cut section shows multiple abscesses in cortex and medulla. The pelvicalyceal system is congested and contain purulent exudate.

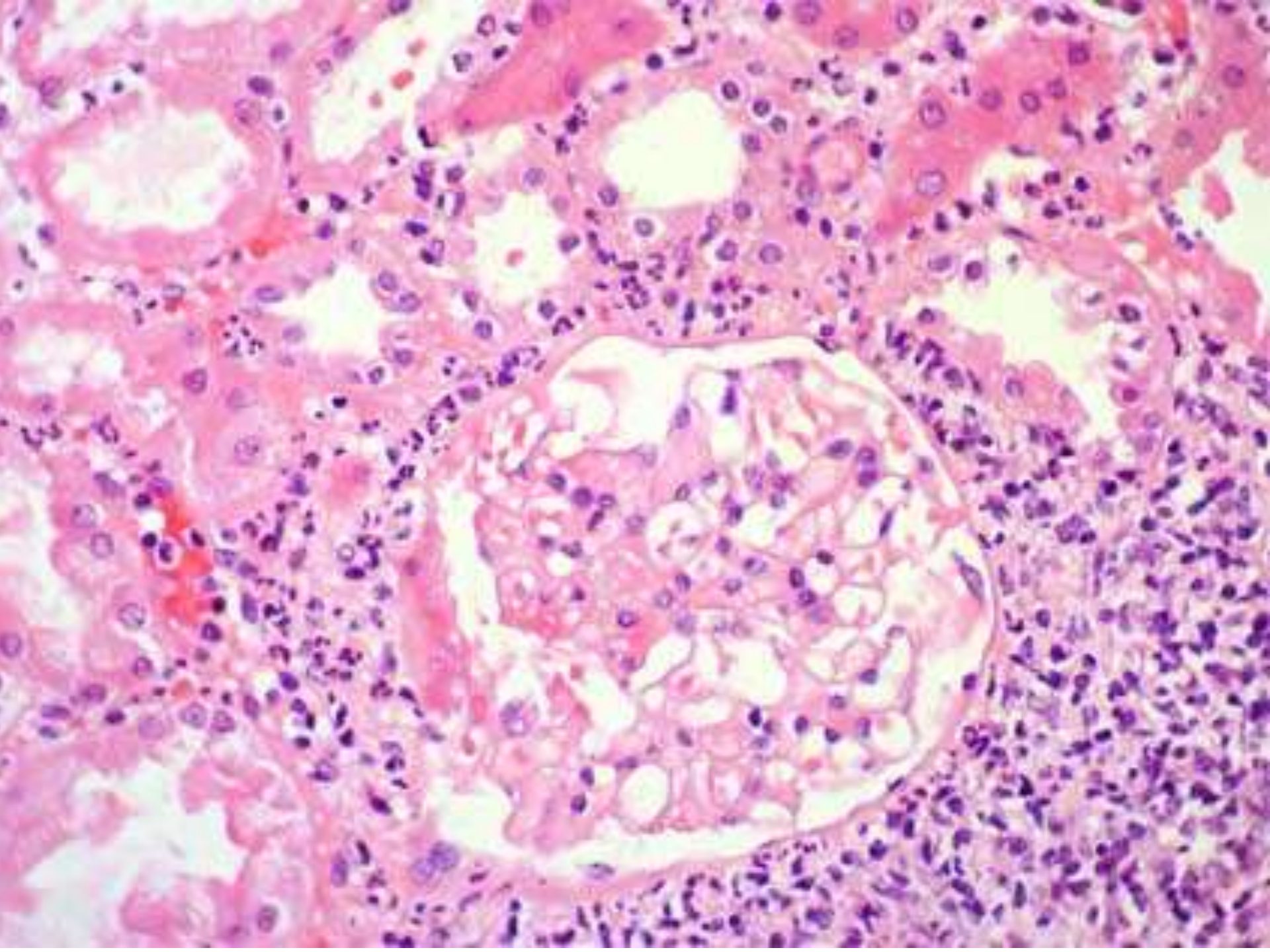
Microscopic picture:

The interstitial tissue is infiltrated by polymorphonuclear leucocytes and pus cells. the tubules show tubular degeneration, necrosis and leucocytic casts. The calyces and pelvis are hyperaemic, oedematous and infiltrated by acute inflammatory cells.

Clinically: fever, renal tenderness, dysuria and pyuria.

Course:

1. Resolution and recovery in mild cases.
2. Change to chronic pyelonephritis.
3. In sever, bilateral affection; death from acute renal failure.



II- Chronic pyelonephritis:

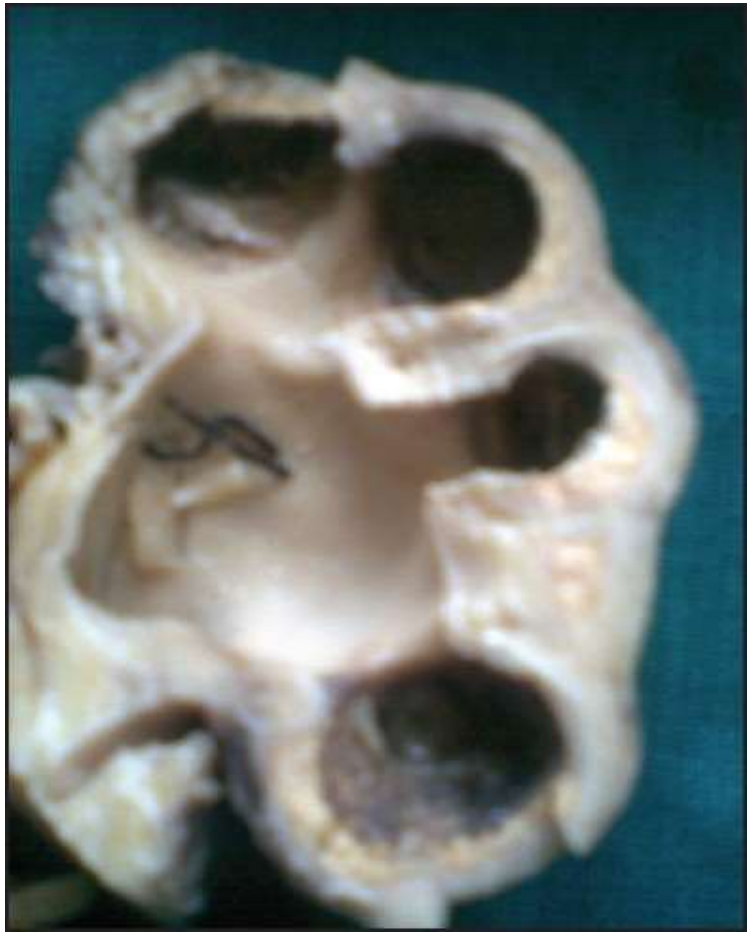
May follow acute pyelonephritis but commonly starts as a chronic inflammation.

Gross picture:

The kidney is reduced in size, the capsule is thick and adherent.

The surface shows irregular depressions due to cortical scarring.

The pelvi-calyceal System is thickened, distorted and contain purulent material.

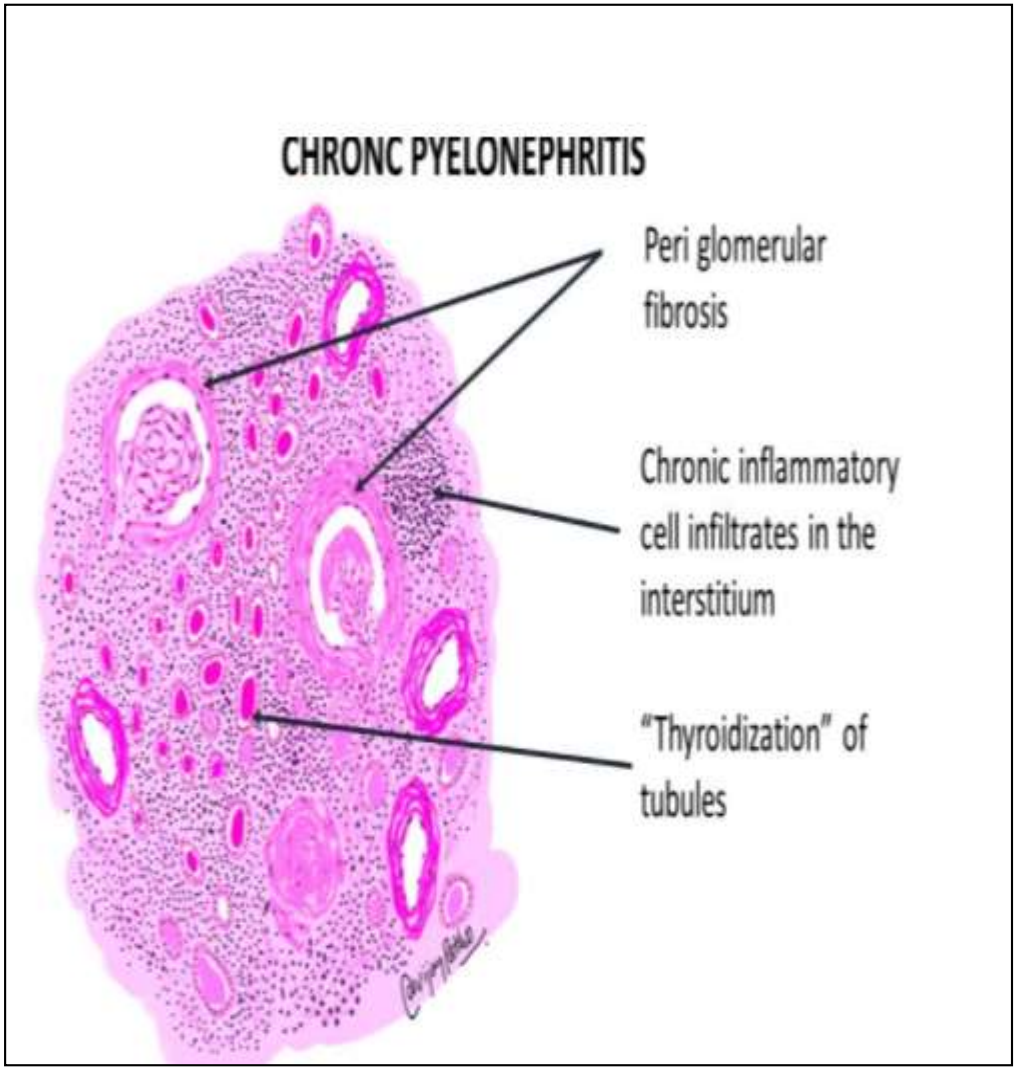


- **Microscopic picture:**

The interstitial tissue is infiltrated by lymphocytes, plasma cells, macrophages, neutrophils and shows broad bands of fibrosis. some tubules are atrophic while others are dilated and contain large hyaline casts (thyroidization). The blood vessels are thickened.

- **Effects:**

1. Chronic renal failure.
2. Secondary hypertension.



RENAL CALCULI

Aetiology

several factors are responsible for precipitation of urinary crystalloids and stone formation.

1. **Stasis**: facilitates precipitation of urinary salts and ans predispose to bacterial infection.

- Stasis may results from:
- Obstruction to urinary outflow as in BPH, Prostatic carcinoma.
- Prolonged recumbency after bone fracture.

2. **Increased urinary concentration:** as in cases of;

- Limited intake of water.
- Hot weather and excessive sweating.

3. Infection: infection leads to stone formation by the following;

- Changing PH of the urine causes precipitation of different urinary salts.
- Pyogenic bacteria decompose urea into ammonia causing alkalinity and phosphate deposition.
- The products of inflammation as shedded epithelial cells, fibrin, blood clots and pus cells act as nuclei for stone formation.

4. Metabolic disorders:

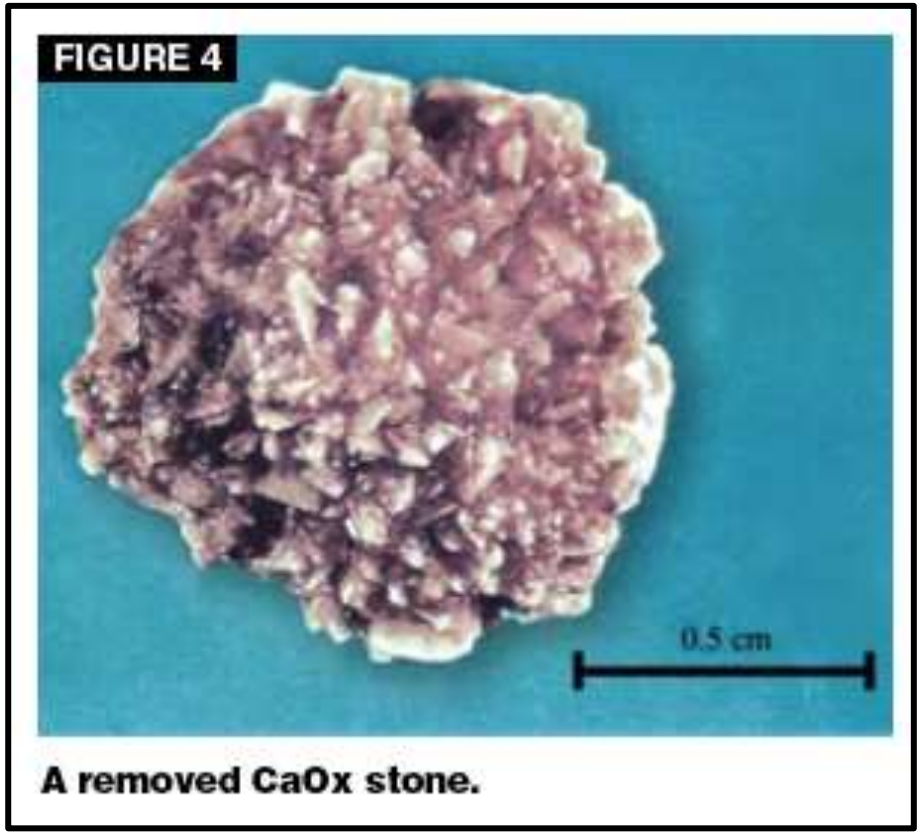
- Hypercalcuria in hyperparathyroidism.
- Increases oxalate secretion in oxaluria as in excess intake of tomato, spinach.

Types of renal stones:

I- Primary or metabolic stones

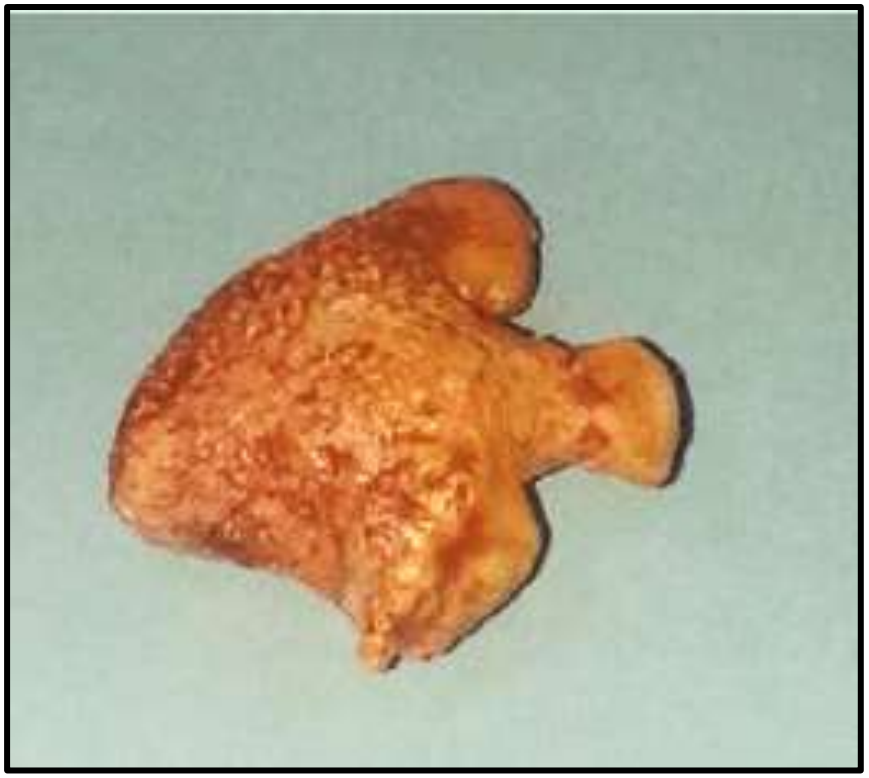
1- oxalate stones

- Composed of calcium oxalate and develop primary in the renal pelvis in acidic urine.
- Oxalate stones are multiple, small, hard with rough, spiny surface. They cause mucosal injury and haemorrhage. The deposited blood pigments on the surface of the stone gives it a dark-brown or black color.



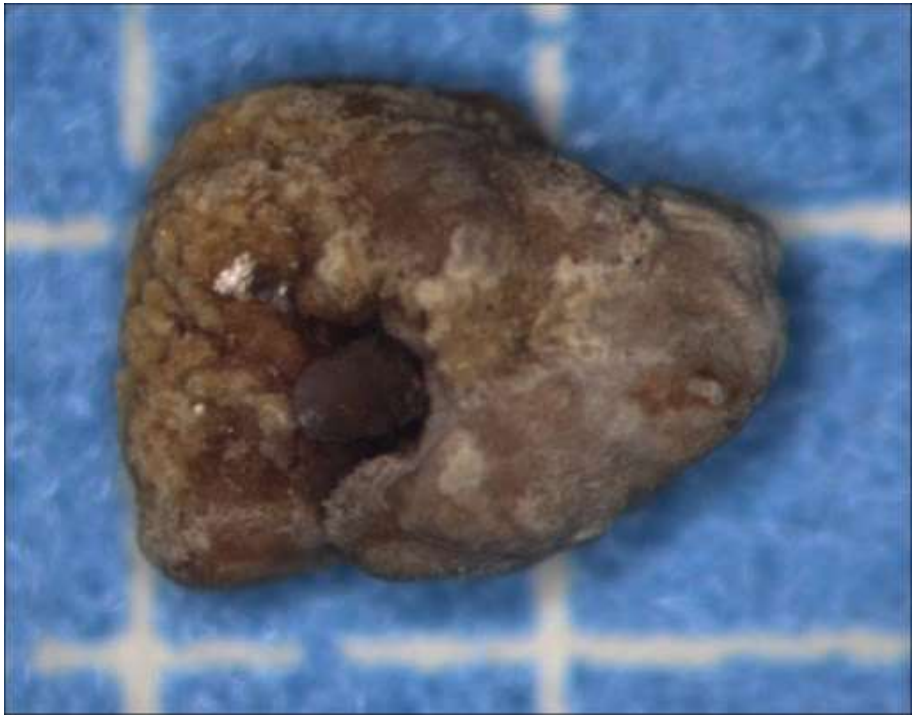
2- **Uric acid and urate stones**

- Composed of uric acid, sodium urate and ammonium urate. They develop in the pelvis and calyces in acidic urine. The stone is usually single, hard, round to oval, yellowish-brown with smooth outer surface. The stone may enlarge and takes the shape of the renal pelvi-calyceal system producind a ***staghorn or coralline stone.***



3- **Cystine stones**

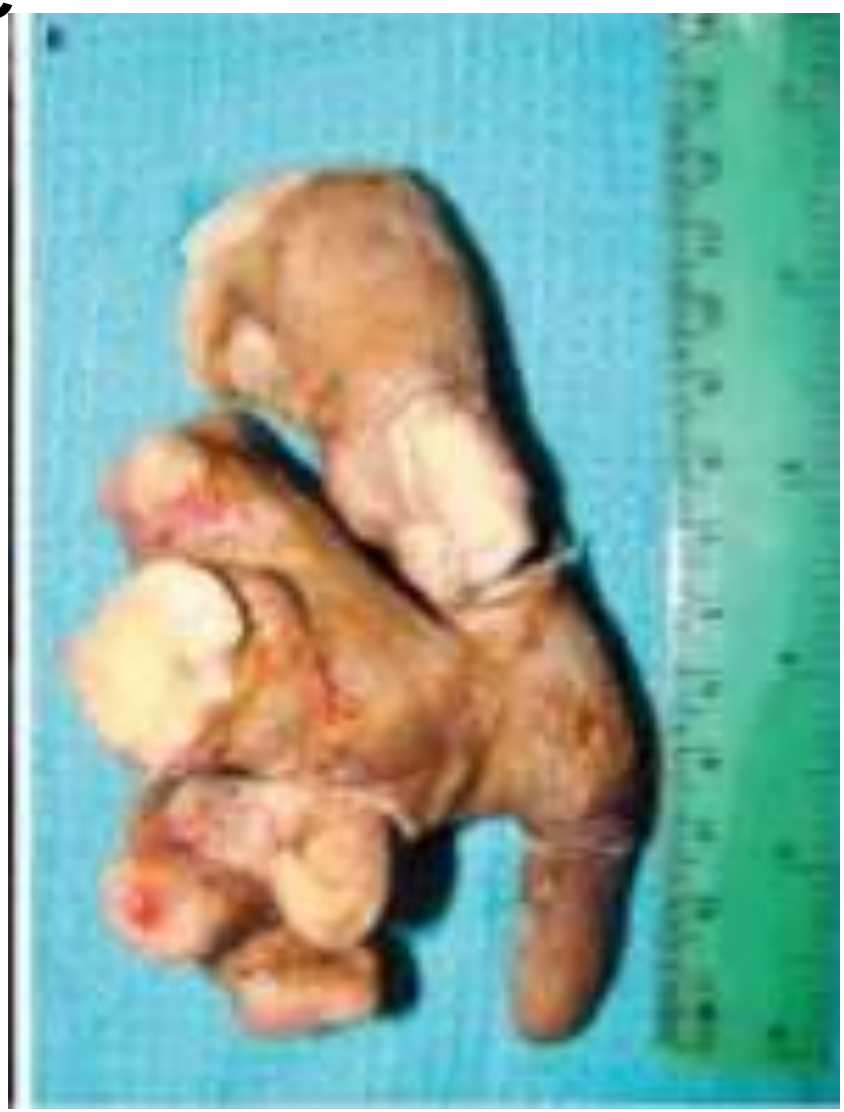
- Rare, develop in cases of cystinuria. The stone is soft and yellowish-green.



II- **Secondary or infection stones**

Phosphate stone

- Composed of calcium phosphate and develop in bladder in infected, alkaline urine. The stone is rounded, white with smooth surface. It is friable, chalky and the internal structure is amorphous. A small urate or oxalate stone reaching the bladder may form a nucleus for a bigger phosphate stone when infection occurs.



Effects and complications of renal stones

1-Pain:

- Dull aching pain (big stone).
- Renal colic resulting from contraction of ureteric muscle to move a small stone down the ureteric lumen.

2-Mechanical irritation cause:

- Haematuria.
- Mucosal ulceration with subsequent stenosis.
- Squamous metaplasia and leukoplakia.
- Bladder carcinoma.

3-Obstructive effects:

- Hypertrophy and dilatation of the bladder with diverticulae formation.
- Hydroureter and hydronephrosis.

4-Infection:

- Obstruction by stones facilitates infection with development of cystitis, urethritis, pyelonephritis, pyoureter and pyonephrosis.

Renal cell carcinoma

Renal cell carcinoma

- It is a common tumor which arises from the epithelium of the renal tubules or from a cortical adenoma. The tumor is more common in males between the age of 40-70 years old.

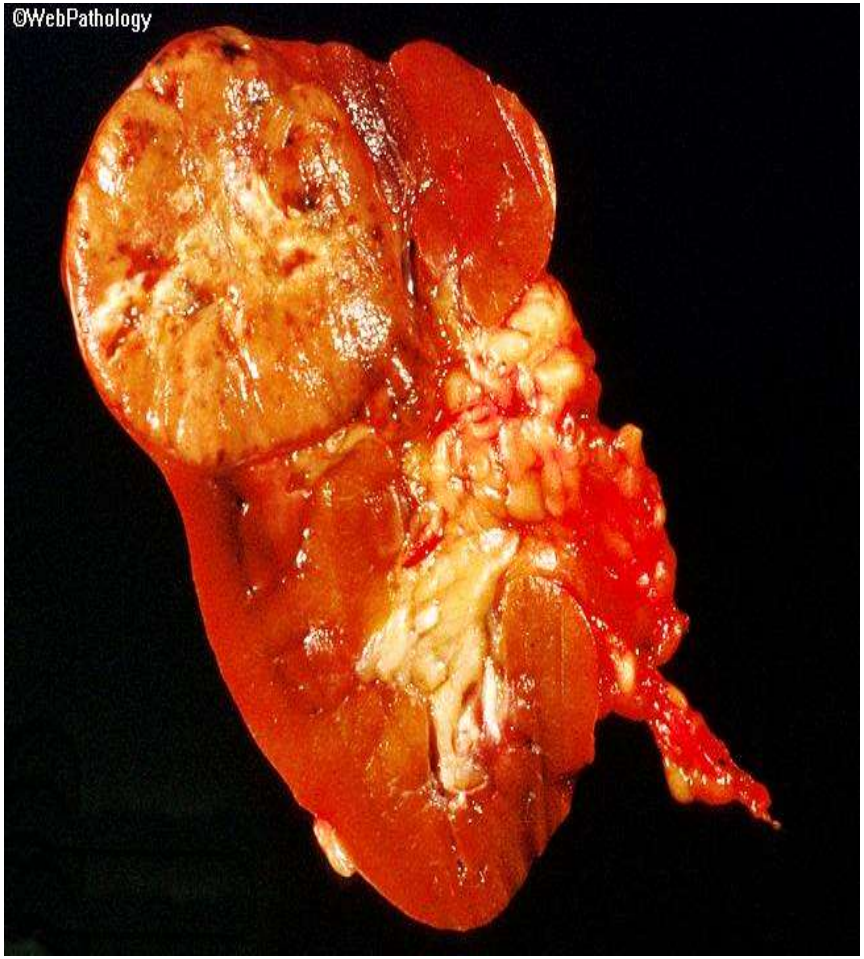
Clinical picture

- Painless haematuria.
- Loin pain.
- Palpable loin mass.
- Obstruction of spermatic veins by tumor produce varicocele.

Pathological features

Gross picture:

The tumor presents at one side of the kidney. It forms a variable sized, rounded sharply demarcated mass. Cut surface of the tumor has a characteristic yellow color due to high lipid content of the tumor cells. it usually shows areas of haemorrhage, necrosis and cystic change.

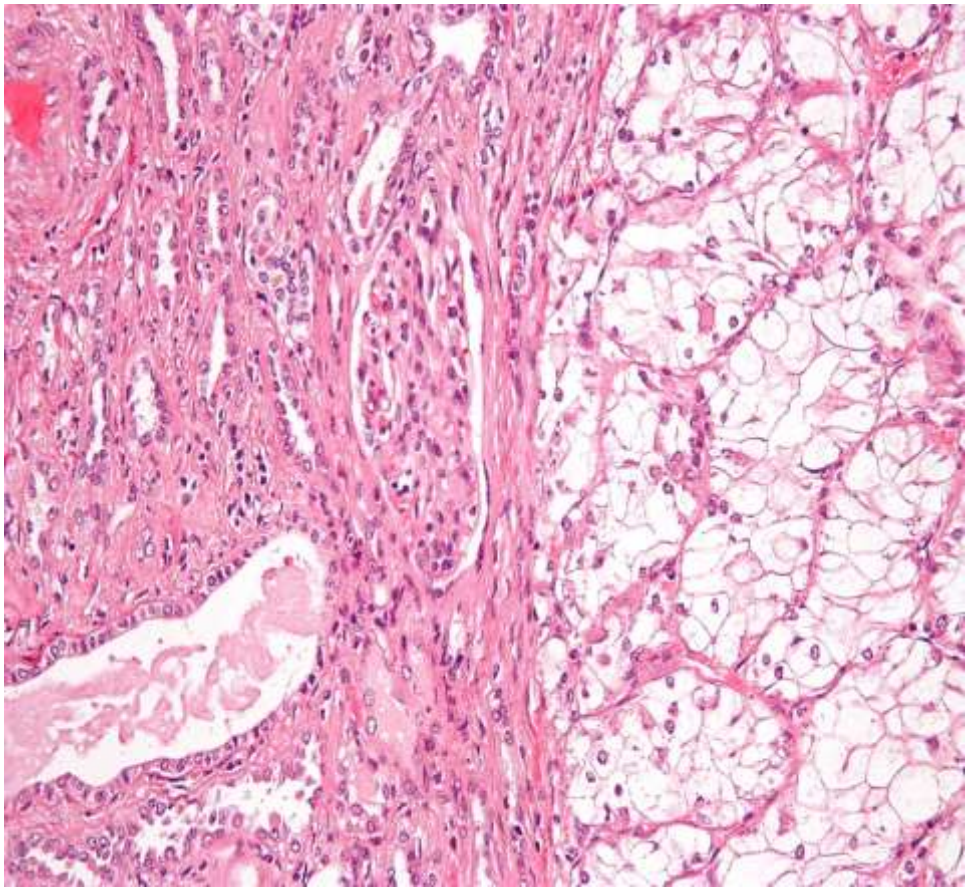


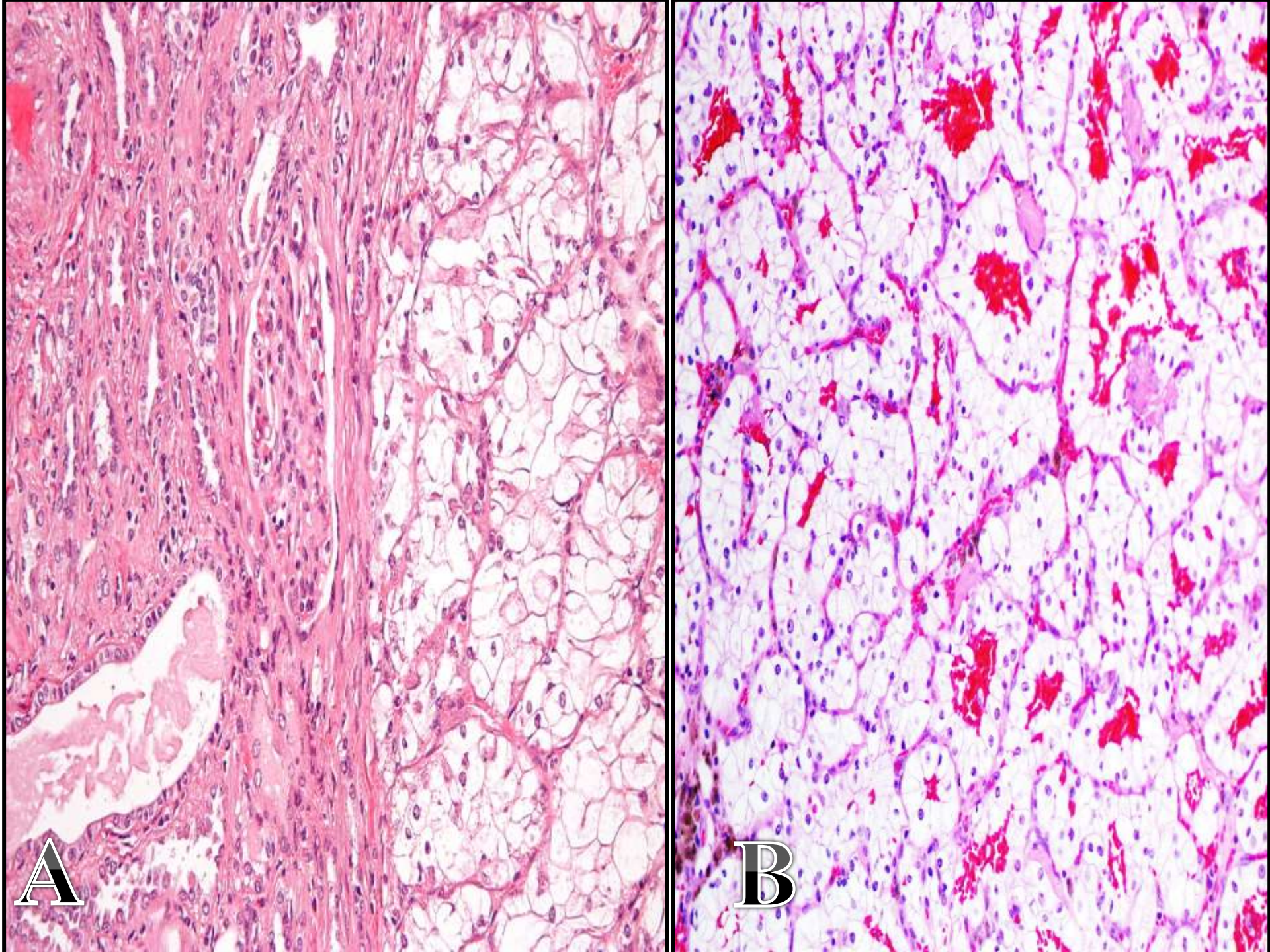
Microscopic picture

Microscopically; RCCs may show different morphological pictures.

Clear cell RCC

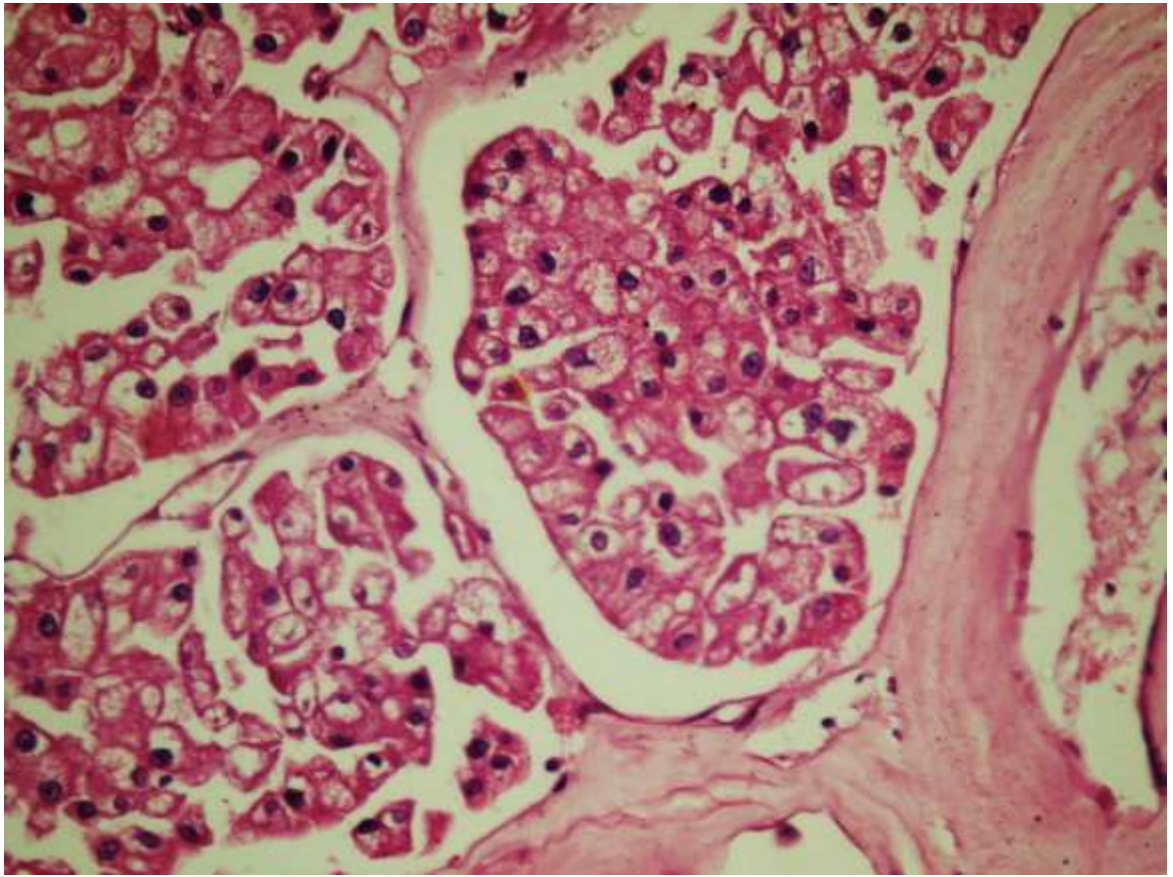
- It is the commonest type. The cells are large, rounded or polyhedral and arranged in acini or trabeculae separated by scanty stroma containing thin walled blood vessels. The cytoplasm is clear or vacuolated due to high content of lipid and glycogen. The nucleus is small and darkly stained.




A
B

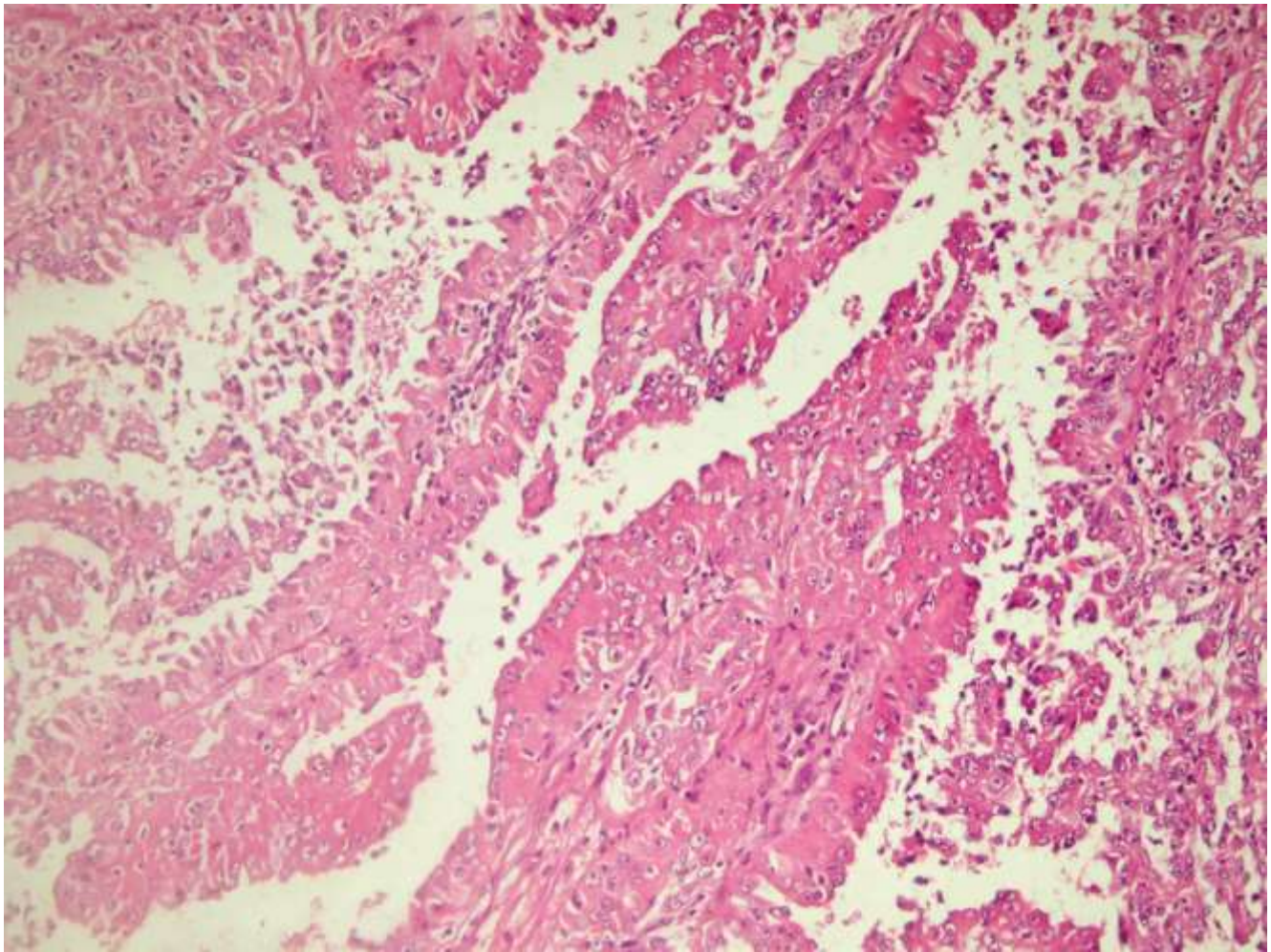
Chromophobe cell type

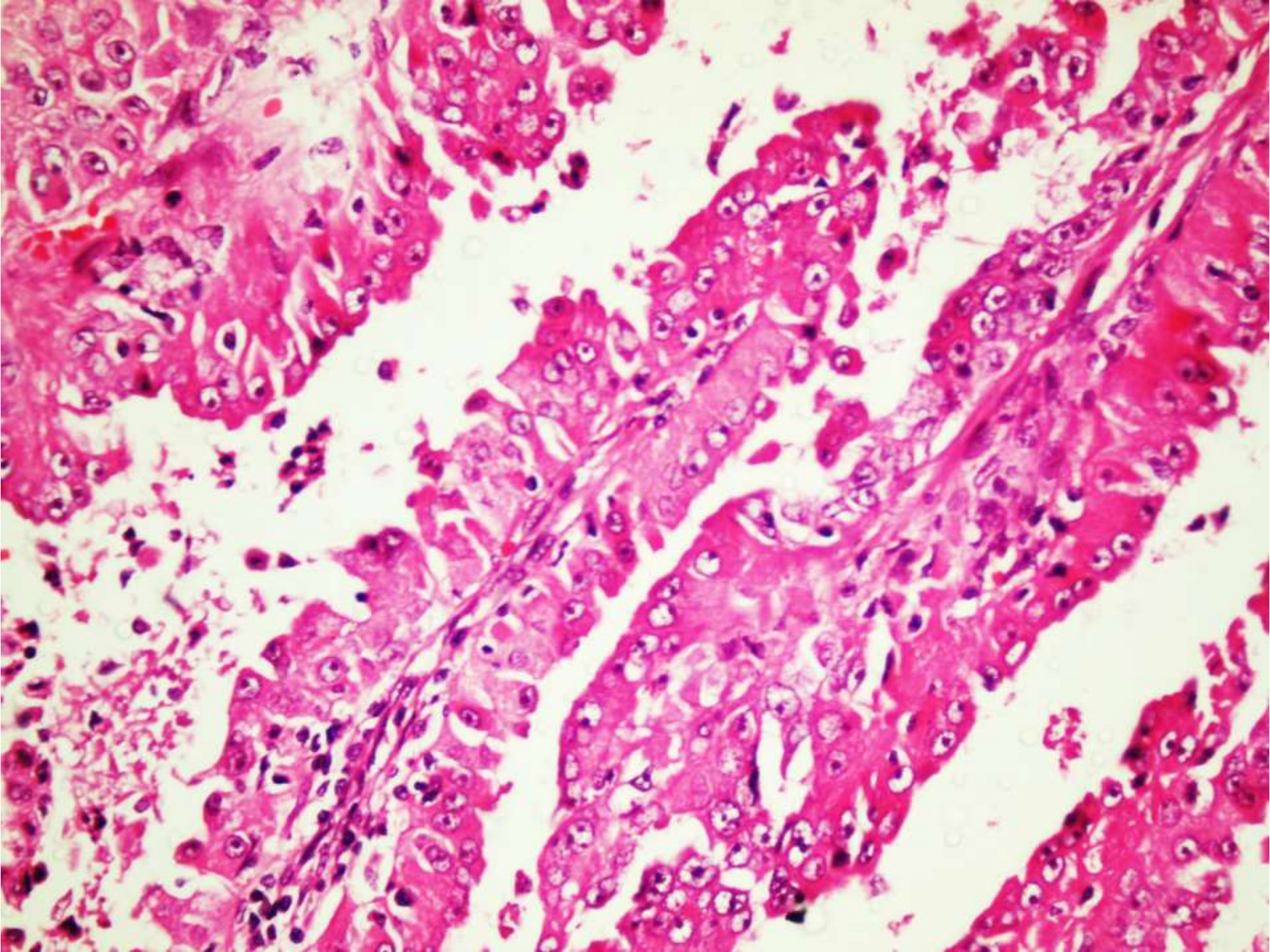
- The tumor cells are small, cuboidal with eosinophilic granular cytoplasm and tend to form solid sheets. The stroma show amyloid-like material.



Papillary type

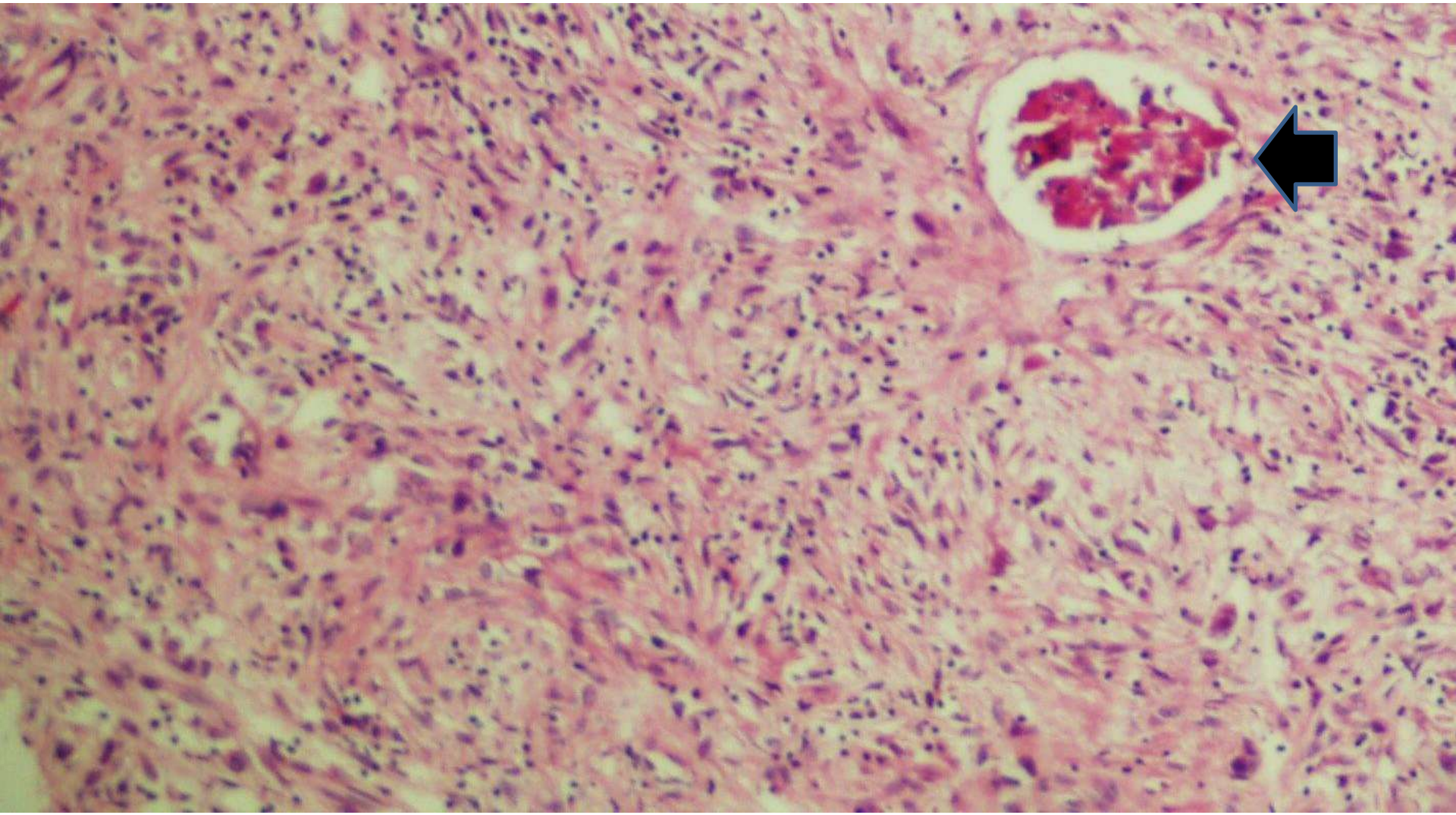
- The tumor cells form tubular structures or dilated cysts with papillary formations. The cells are columnar in shape.

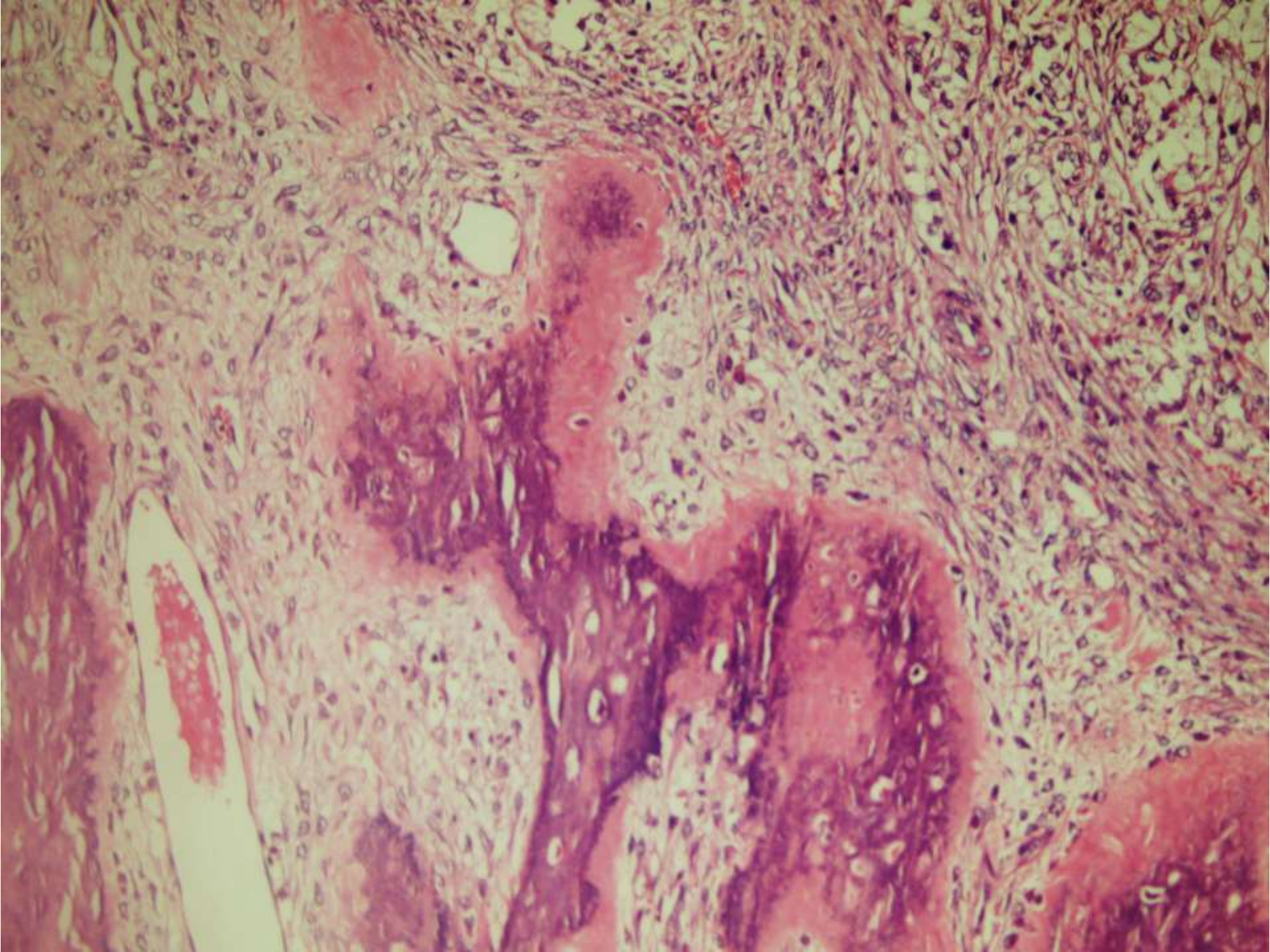




Sarcomatoid type

- The cells are spindle shaped and undifferentiated.





Spread

- **Direct spread:** to renal capsule, renal pelvis, renal vein or even inferior vena cava.
- **Blood spread:** to lung, bone and liver.
- **Lymphatic spread:** to para-aortic lymph nodes.

Wilm's tumor (Nephroblastoma or Embryoma)

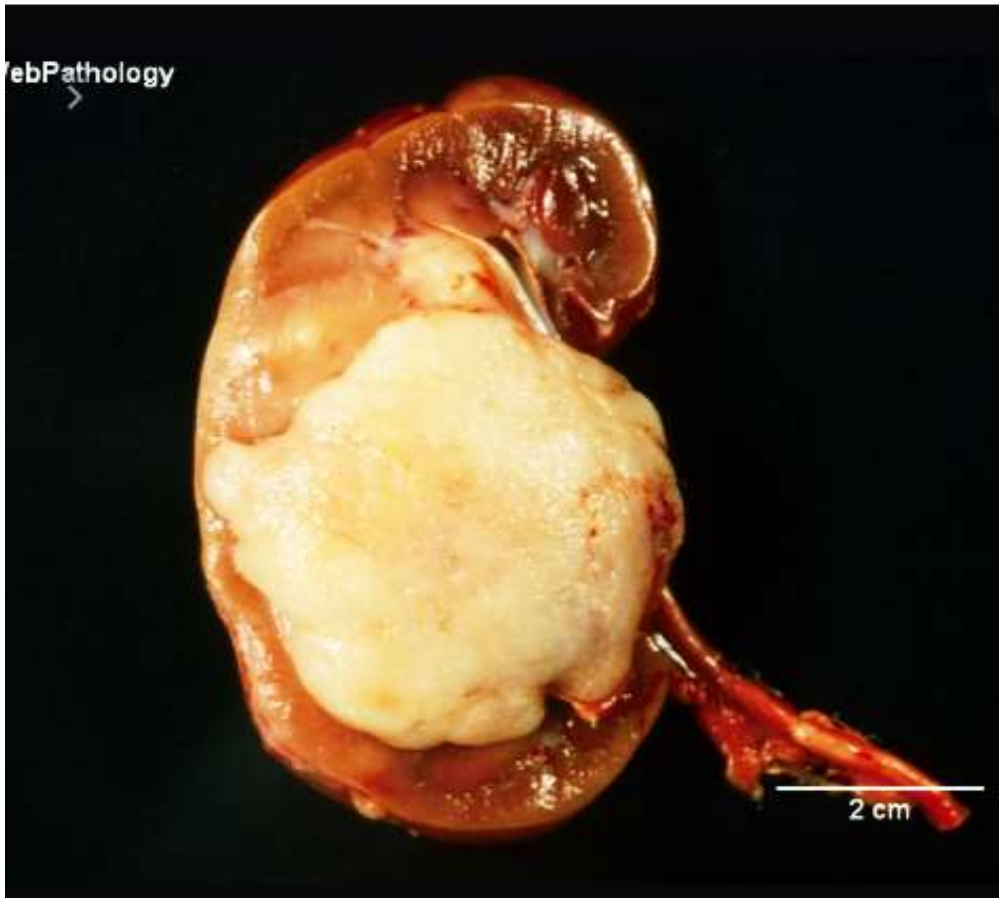
Wilm's tumor (Nephroblastoma or Embryoma)

- It is a childhood (Embryonal) tumor derived from renal blastema. The peak incidence is 2-4 years. This tumor forms 20% of malignant tumors in children.

Pathological features

Grossly:

A large, rounded or lobulated well circumscribed, soft mass. Cut section is pale grey showing areas of cystic changes, haemorrhage and necrosis.

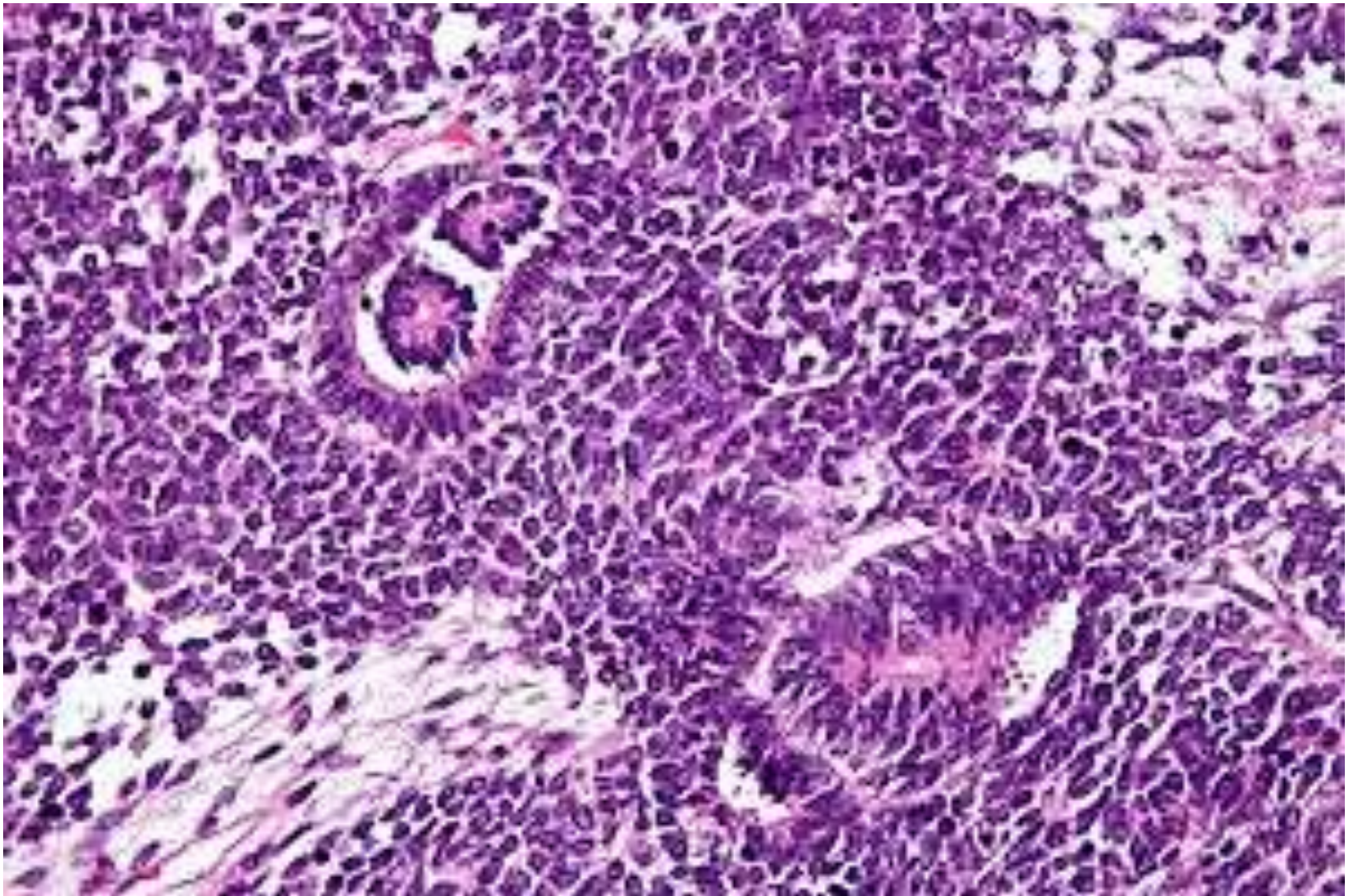


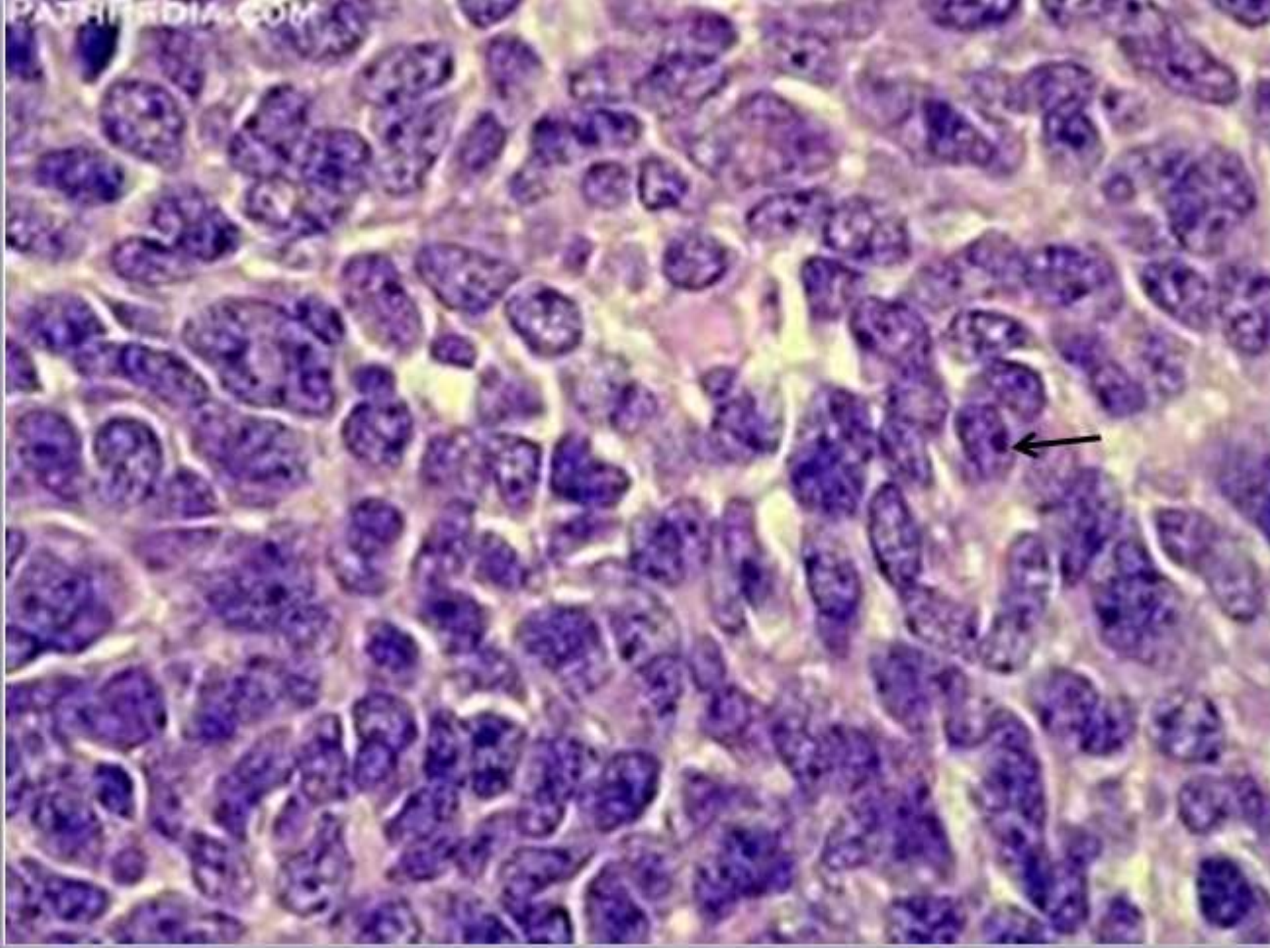
Pathological features

Microscopic picture:

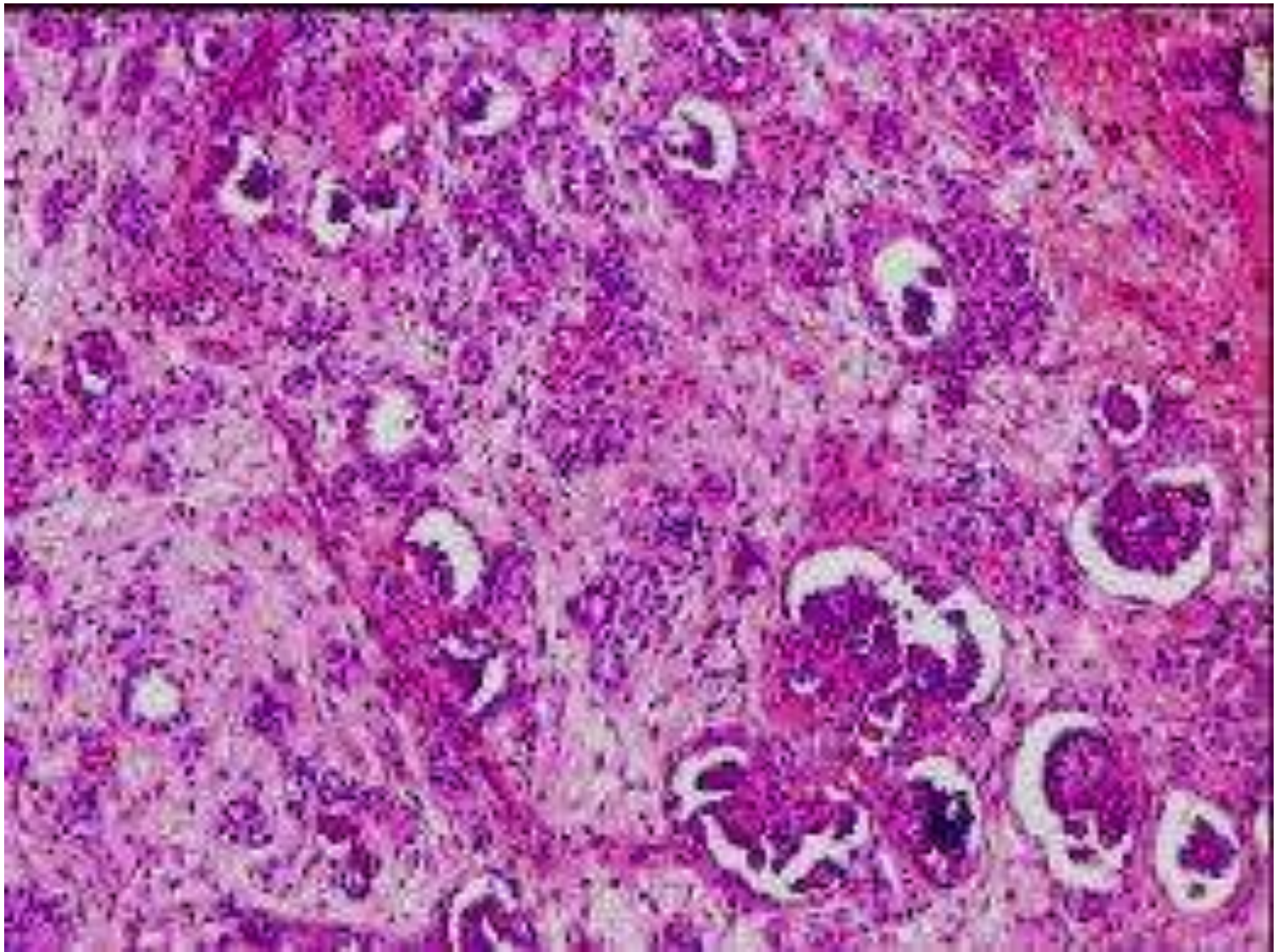
The tumor consists of three components: 1) cellular nests and sheets of primitive blastemal cells, round to oval in shape with scanty cytoplasm. 2) mesenchymal components of fibrous tissues, smooth muscle, striated muscle, bone or cartilage. 3) epithelial components of embryonic tubules and glomeruloid structures.

Blastemal Components

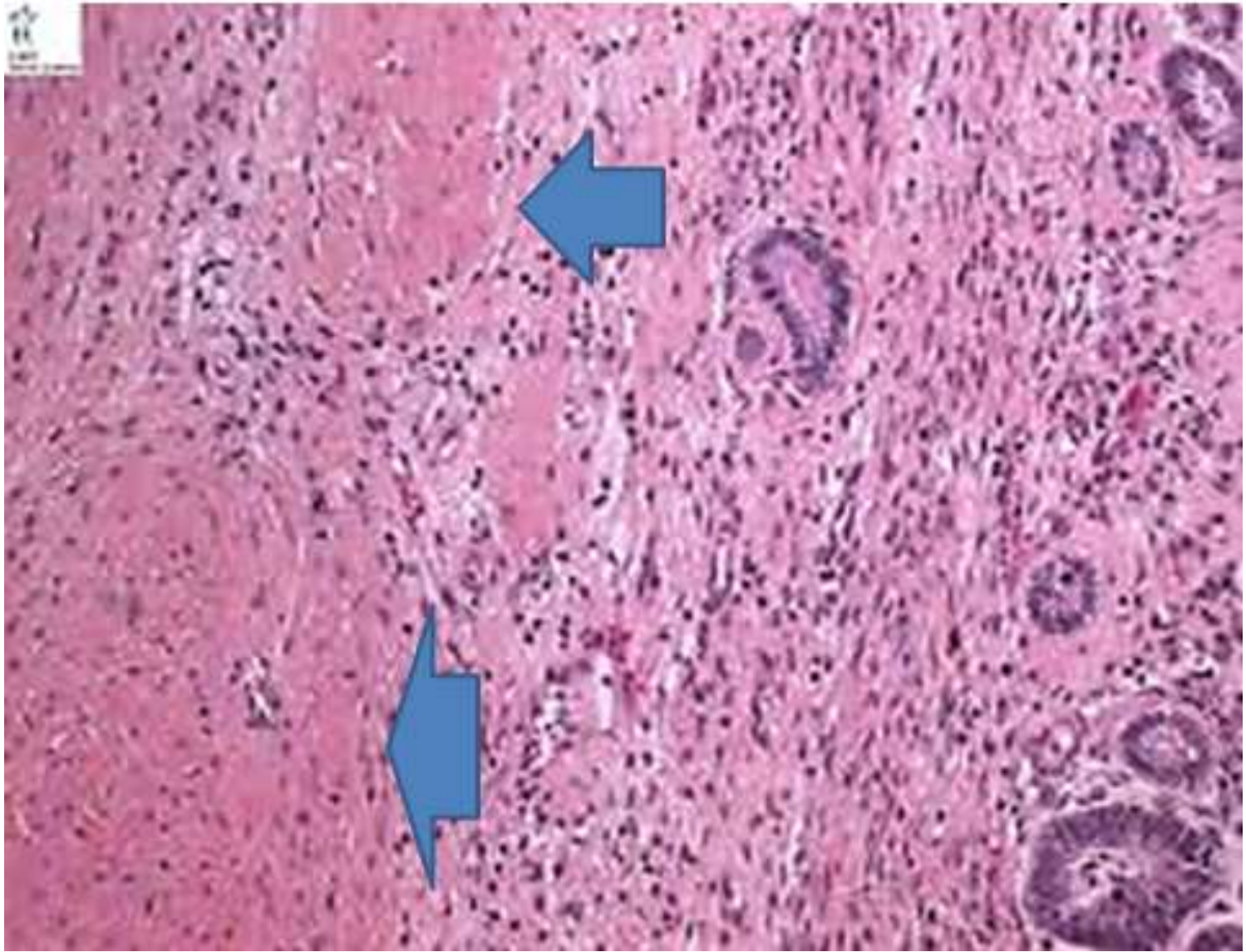




Epithelial components, abortive glomeruli



Mesenchymal Components



Spread

- **Local spread:** it infiltrates renal capsule and surroundind structures.
- **Blood spread:** to lung, liver, bone and brain.
- **Lymphatic spread:** to para-aortic lymph nodes.

Bladder carcinoma

Bladder carcinoma

Risk factors:

- ✓ Chronic cystitis (due to stone, bilharziasis).
- ✓ Cigarette smoking.
- ✓ Chemical carcinogens as aniline dyes.
- ✓ Villous papilloma.

Pathological features

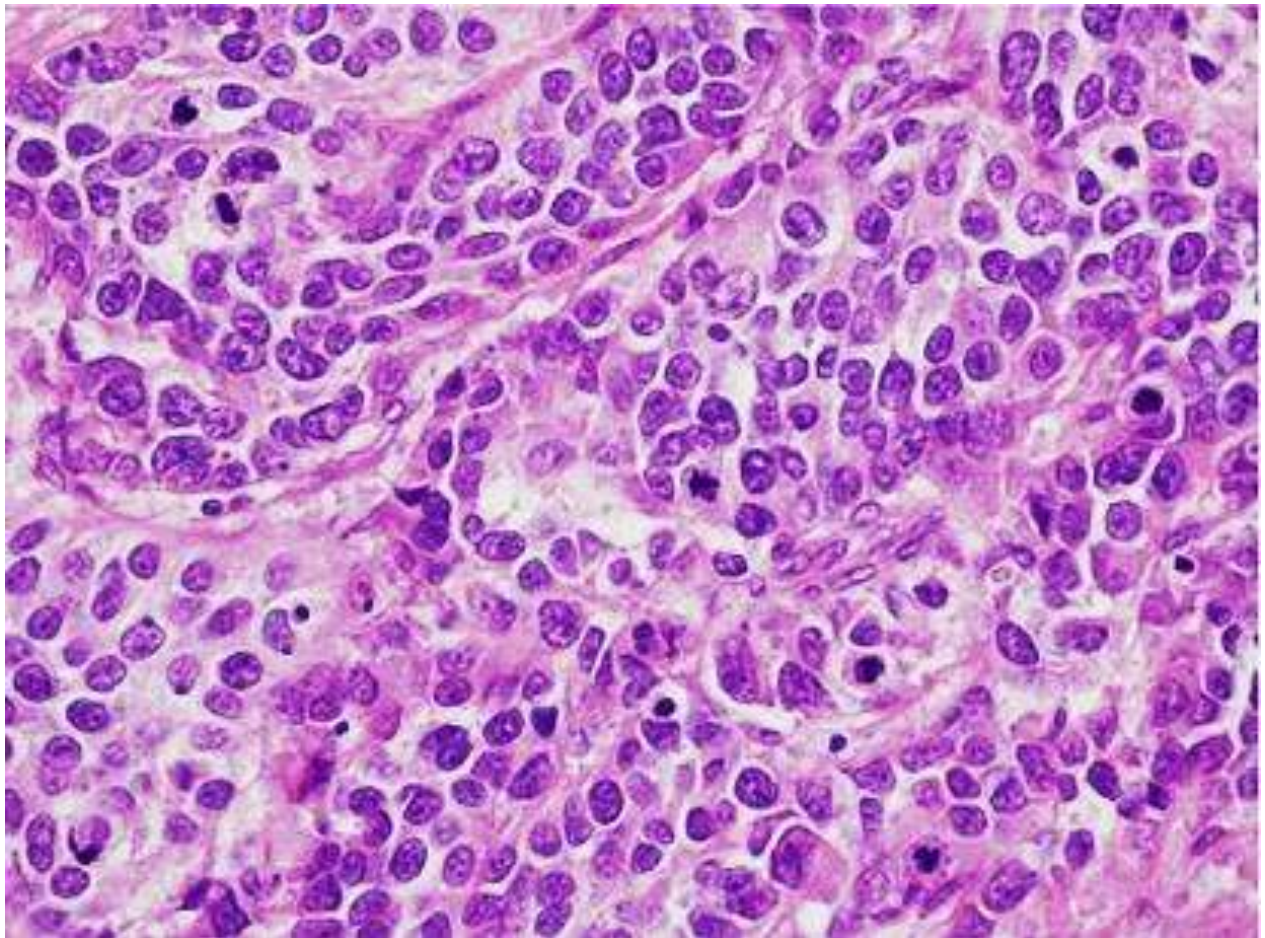
Gross picture:

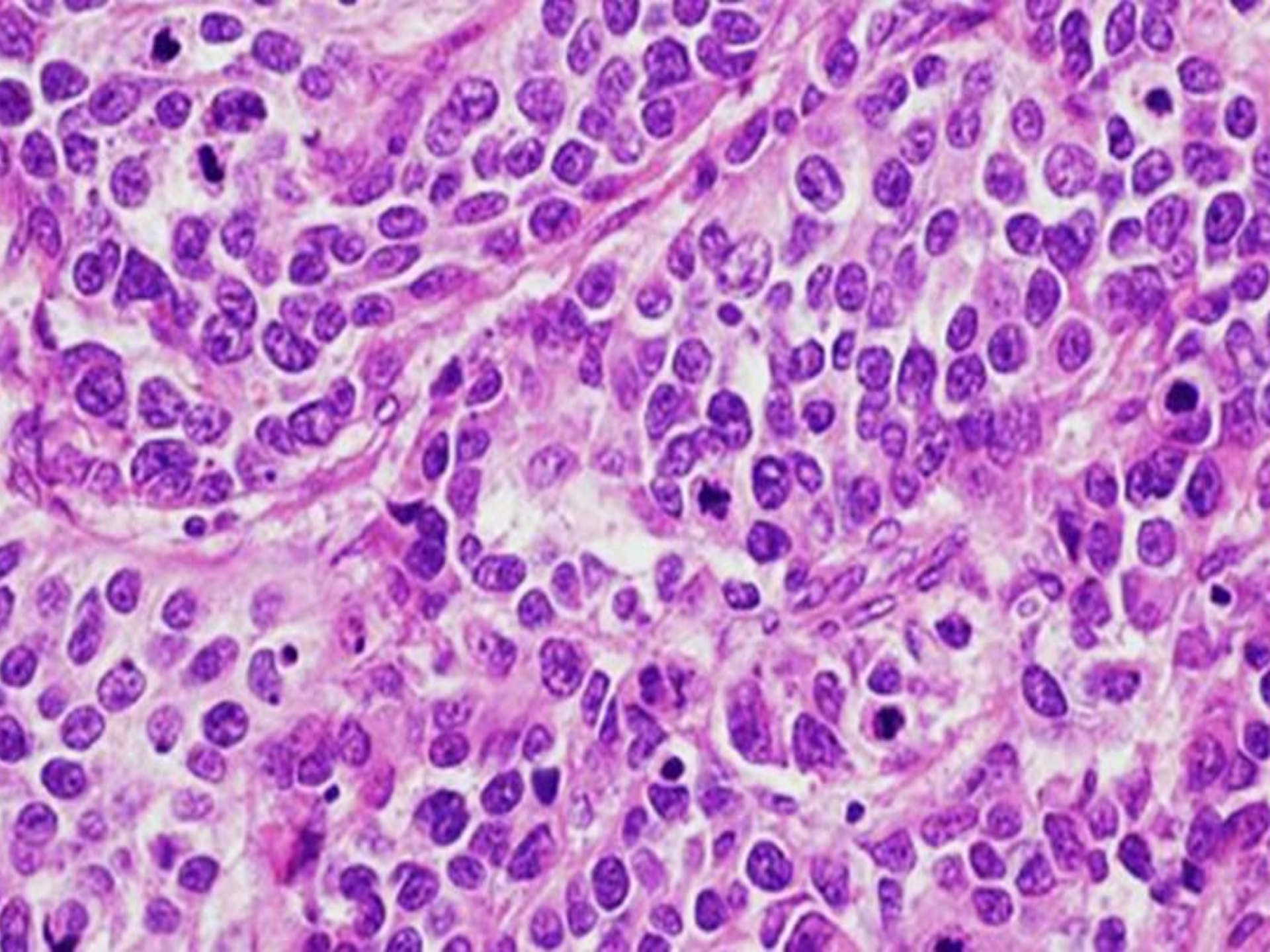
A polypoid mass arise from the bladder wall projecting in the bladder lumen and infiltrate the wall into variable distance. The tumor shows areas of haemorrhage and necrosis.

Microscopic picture:

1- Urothelial carcinoma:

Irregularly distributed neoplastic urothelial cells either with round or jagged contours.





The cells showing criteria of malignancy (pleomorphism, hyperchromatism, increased N/C ratio and frequent mitotic figures). Stromal response vary widely but includes fibrosis, inflammatory reaction, desmoplasia, myxoid change, stromal retraction clefts. The tumor cells invade the different layers of the bladder wall. Divergent differentiation is common, usually in the form of squamous or less commonly glandular differentiation.

2- Squamous cell carcinoma:

Usually preceded by squamous metaplasia in response to chronic bladder irritation as in bilharziasis or bladder stone. The tumor is formed of neoplastic squamous epithelium with variable degree of differentiation.

3- Adenocarcinoma: rare.

Spread of bladder carcinoma

- ✓ **Local spread:** to the ureters, prostate, seminal vesicles uterus, vagina, and rectum. Local spread may result in a malignant fistula between the bladder on one side and vagina, colon or rectum on other side.
- ✓ **Lymphatic spread:** to the hypogastric and iliac lymph nodes.
- ✓ **Blood spread:** to the lung, liver and bone.

➢Complications:

Marked haematuria, hydroureter, hydronephrosis, pyelonephritis and malignant fistulas.

Diseases of Prostate

I- Nodular Hyperplasia of Prostate/ Benign Prostatic Hyperplasia/BPH.

Nodular Hyperplasia of Prostate/ Benign Prostatic Hyperplasia/BPH.

It affects 20%of men by the age of 40 years and 70% by the age of 60 years.

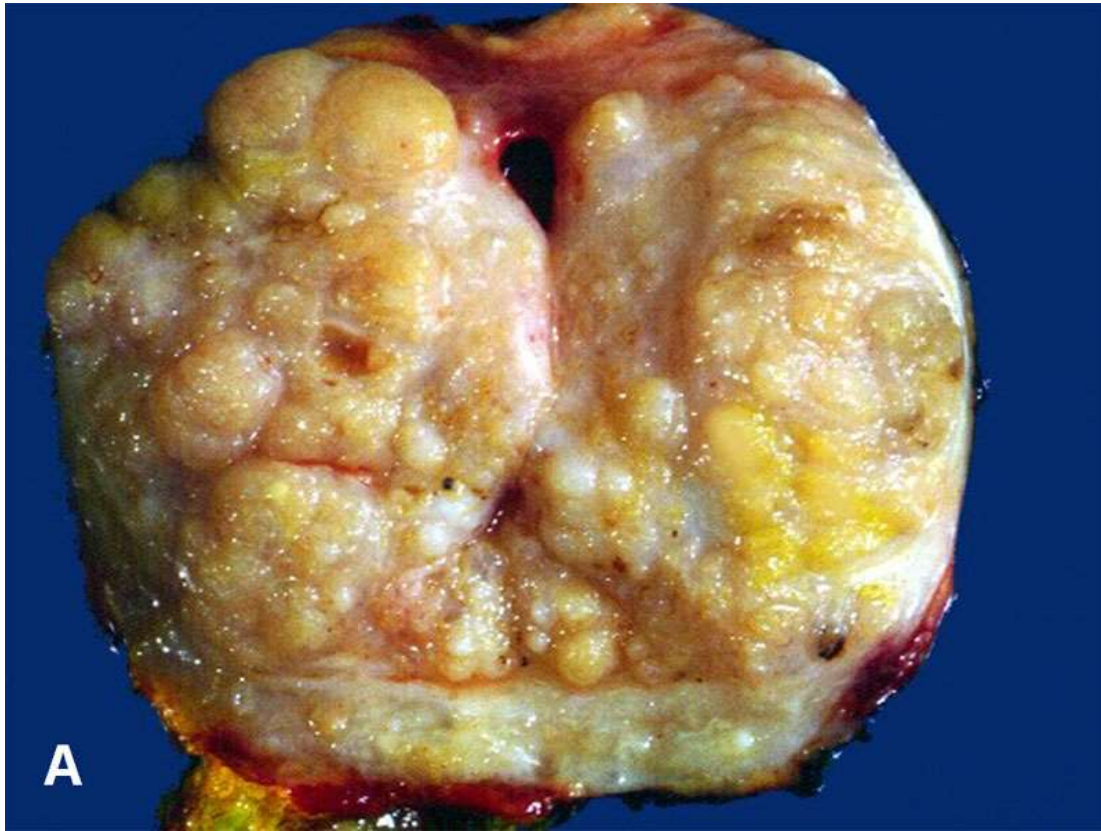
- **Aetiology:**

Dihydrotestosterone (DHT) derived from plasma testosterone mediate prostatic growth. Oestrogen sensetizesthe prostatic tissues to the effect of DHT. BPH has no relation to prostatic carcinoma.

Pathological features

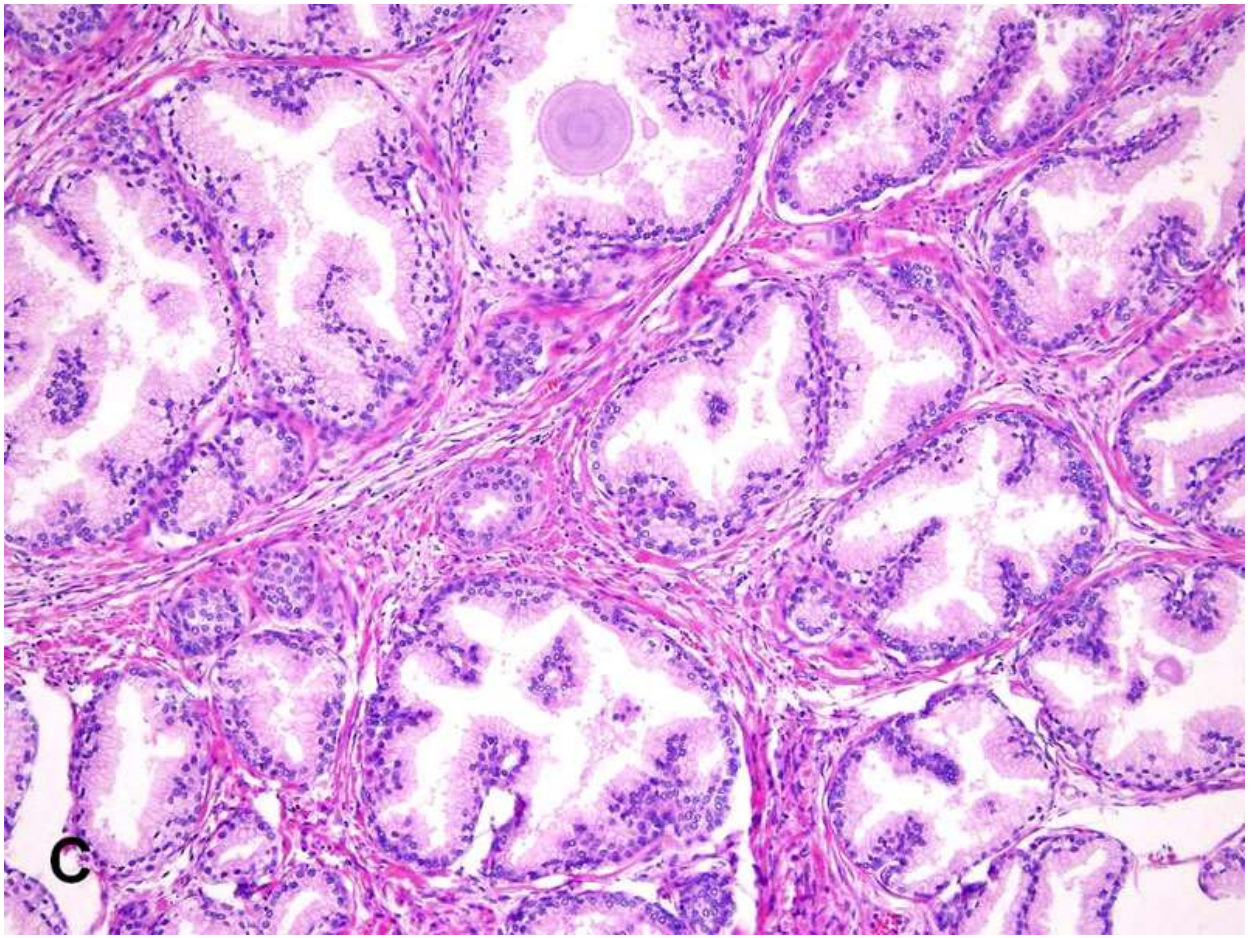
Gross picture:

The enlargement is not symmetrical. It may affect the middle lobe, lateral lobes or both. The enlarged lobes compress the rest of the prostatic tissues in the form of a false capsule. The surface become nodular. Firm and rubbery in consistency. Cut section shows multiple spongy nodules of brownish-yellow color with greyish-white fibrous tissues in between.

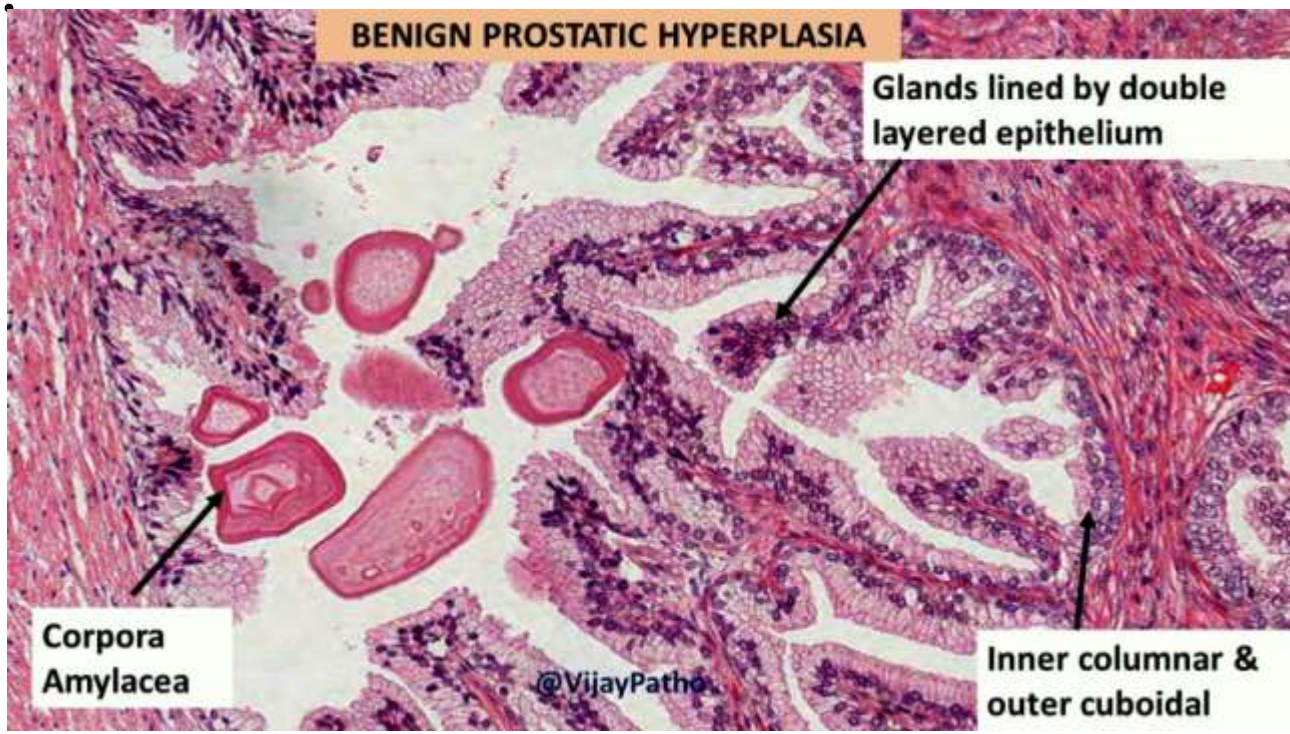


Microscopic picture: the acini show hyperplasia, they are increased in number and become variable in size and shapes. The acini are lined by single or multiple layers of columnar epithelium which may

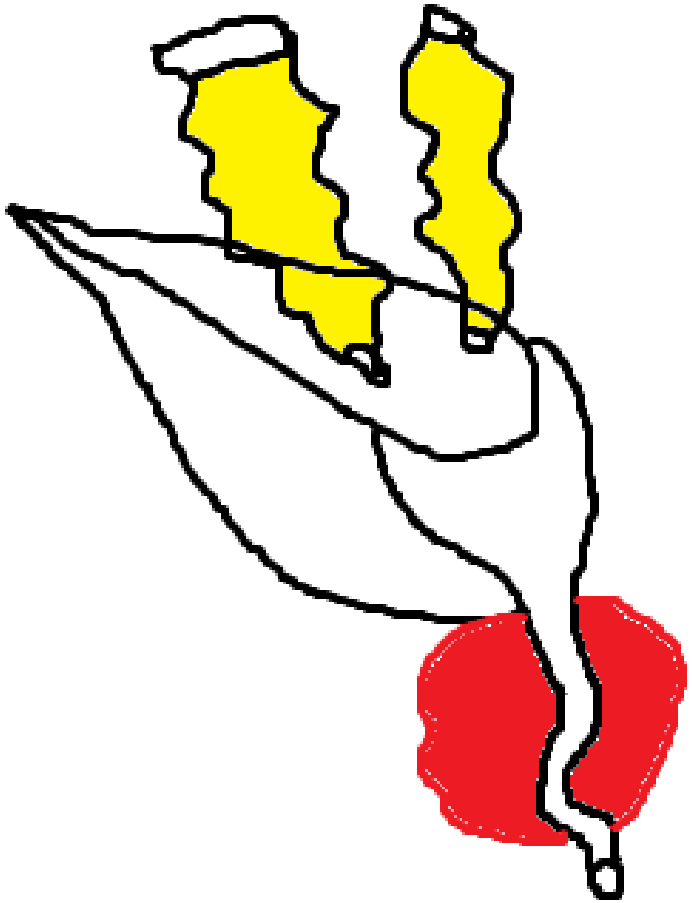
form papillary processes.



The acinar lumen shows shedded epithelial cells mixed with prostatic secretions to form concentric lamellar structures called Corpora Amylacea. Some acini show cystic dilatation. The surrounding fibromuscular stroma are hypertrophies with infiltration by chronic inflammatory cells.



Effects of BPH



Effects of BPH

- **The prostatic urethra** becomes narrow, elongated and tortous causing difficulty in urination.
- **Urinary bladder shows;** hypertrophy of the bladder wall, dilatation.
- **Residual urine** leading to cystitis and phosphate stone formation.
- **Urinary incontinence**.
- **Ureters and kidney:**

Bilateral hydroureters, bilateral hydronephrosis, ascending pyelonephritis, renal failure may occurs.

II- Prostatic carcinoma

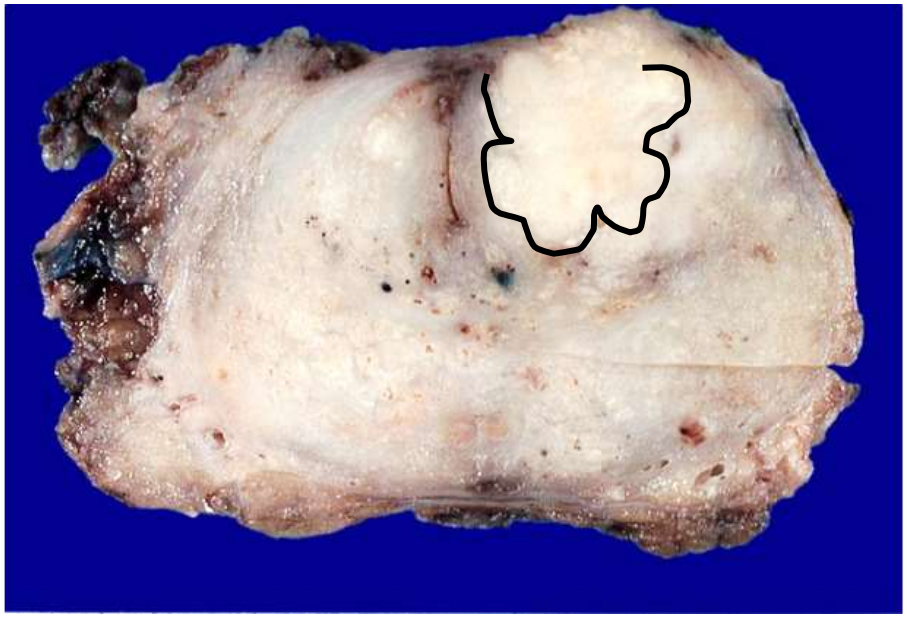
Carcinoma of the prostate

A rather common tumor in males above the age of 60 years old.

Pathological features

Gross picture:

Most prostatic carcinomas arise in peripheral part of the prostate. The tumor appears as poorly demarcated, firm, greyish-yellow color. Advanced tumors may increase in size, infiltrate the rest of prostatic tissue, seminal vesicles, urinary bladder and rarely rectum.



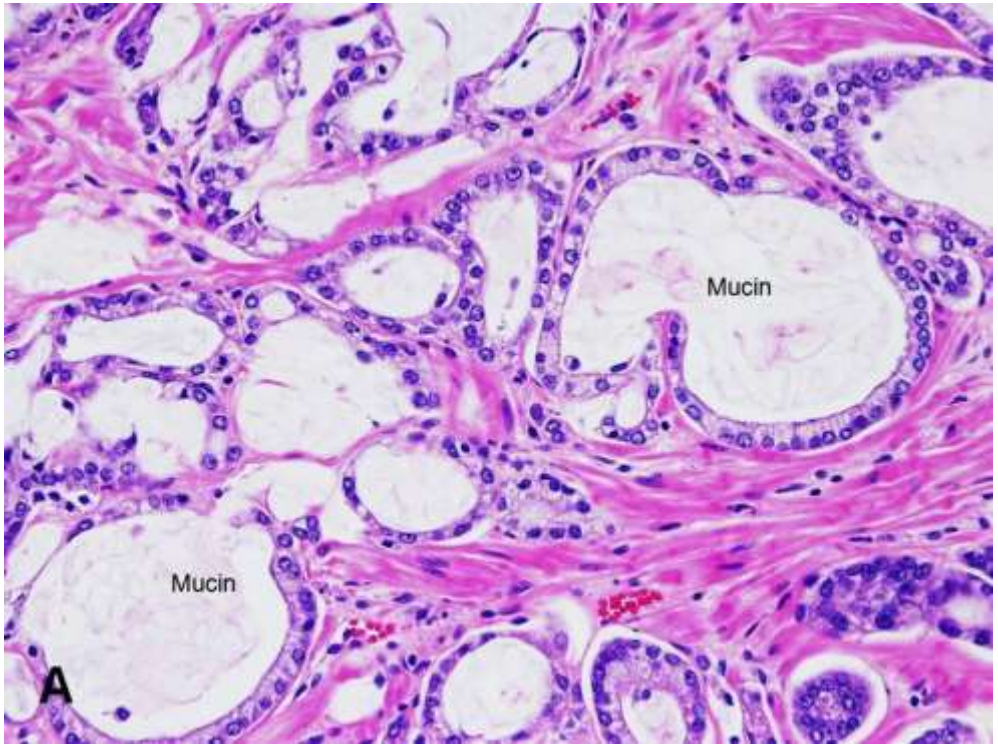
Microscopically:

Adenocarcinoma with all grades of differentiation

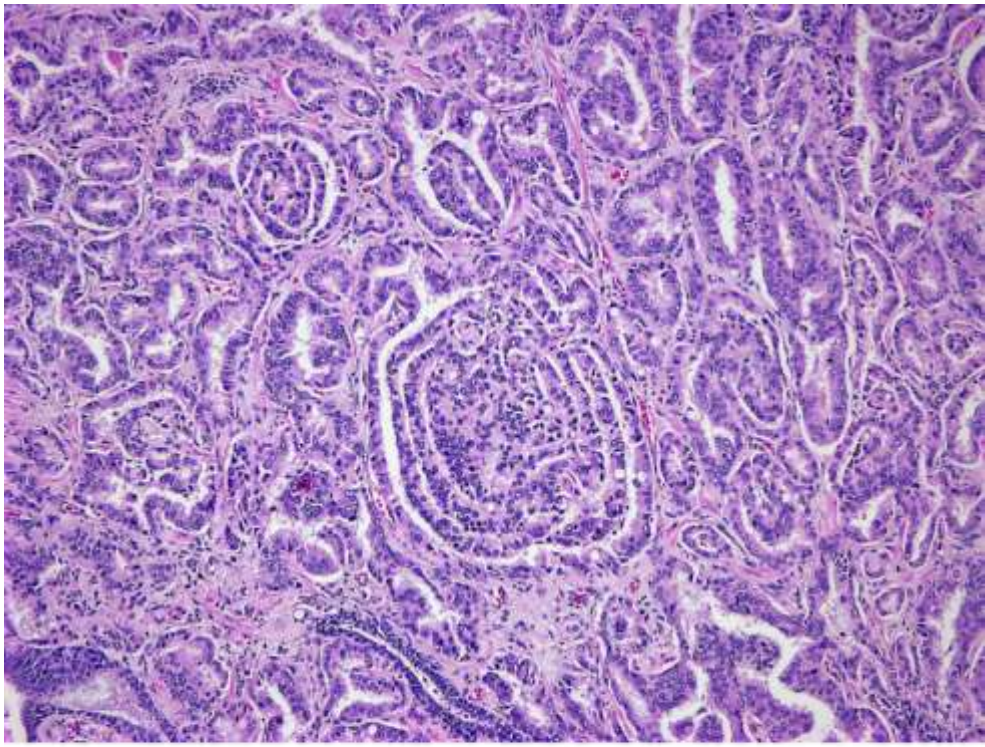
Well differentiated tumors:

the tumor is formed of small acini arranged back to back, medium sized acini or acini showing papillary or cribriform pattern.

The acini are lined by a single uniform layer of cuboidal or low columnar cell. The cytoplasm is pale and often granular. Nuclei areround to oval, vesicular, rare mitosis.



Poorly differentiated tumors: the tumor is formed of neoplastic cells arranged in cords, nests or sheets with no tendency to form acini. The cells are pleomorphic, the nuclei show prominent acidophilic nucleoli and frequent mitotic figures.



Characteristic morphologic features of prostatic adenocarcinoma (10x)

Spread

- **Direct spread:** within the prostatic tissue, urinary bladder, seminal vesicles, rarely to the rectum.
- **Lymphatic spread:** to the iliac, hypogastric, sacral and para-aortic lymph nodes.
- **Blood spread:** to the lung, liver and bone.
- *Bone metastasis mainly affect pelvic bone, sacrum, lumbar vertebrae, ribs and skull.*
- *Usually bone metastasis stimulate new bone formation but sometimes, they cause bone destruction.*

Testicular tumors

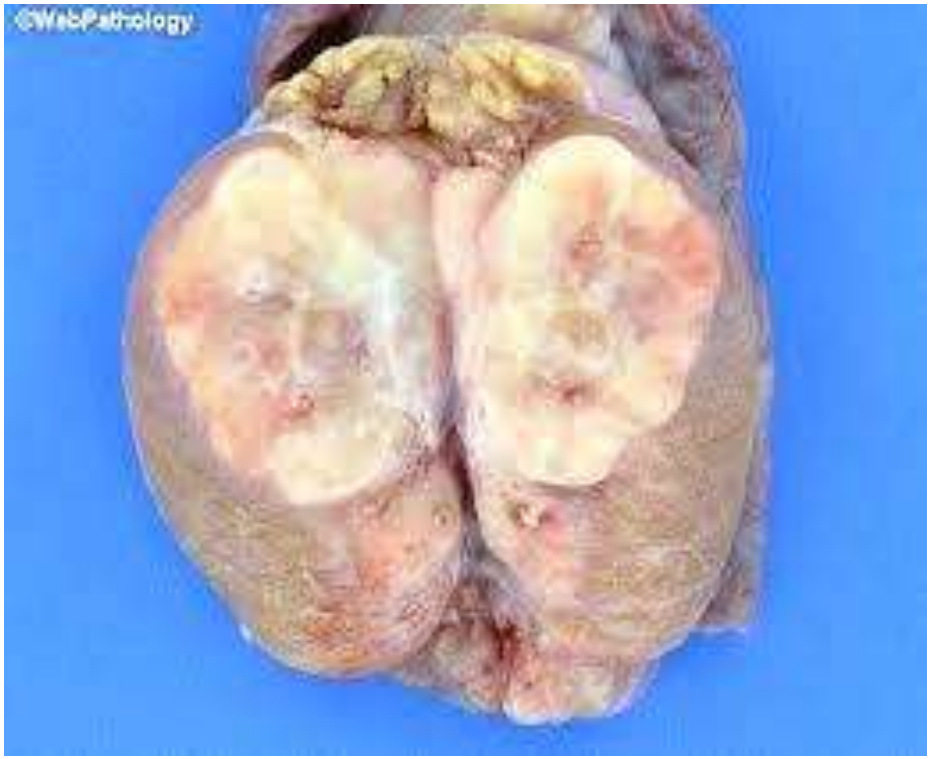
Seminoma

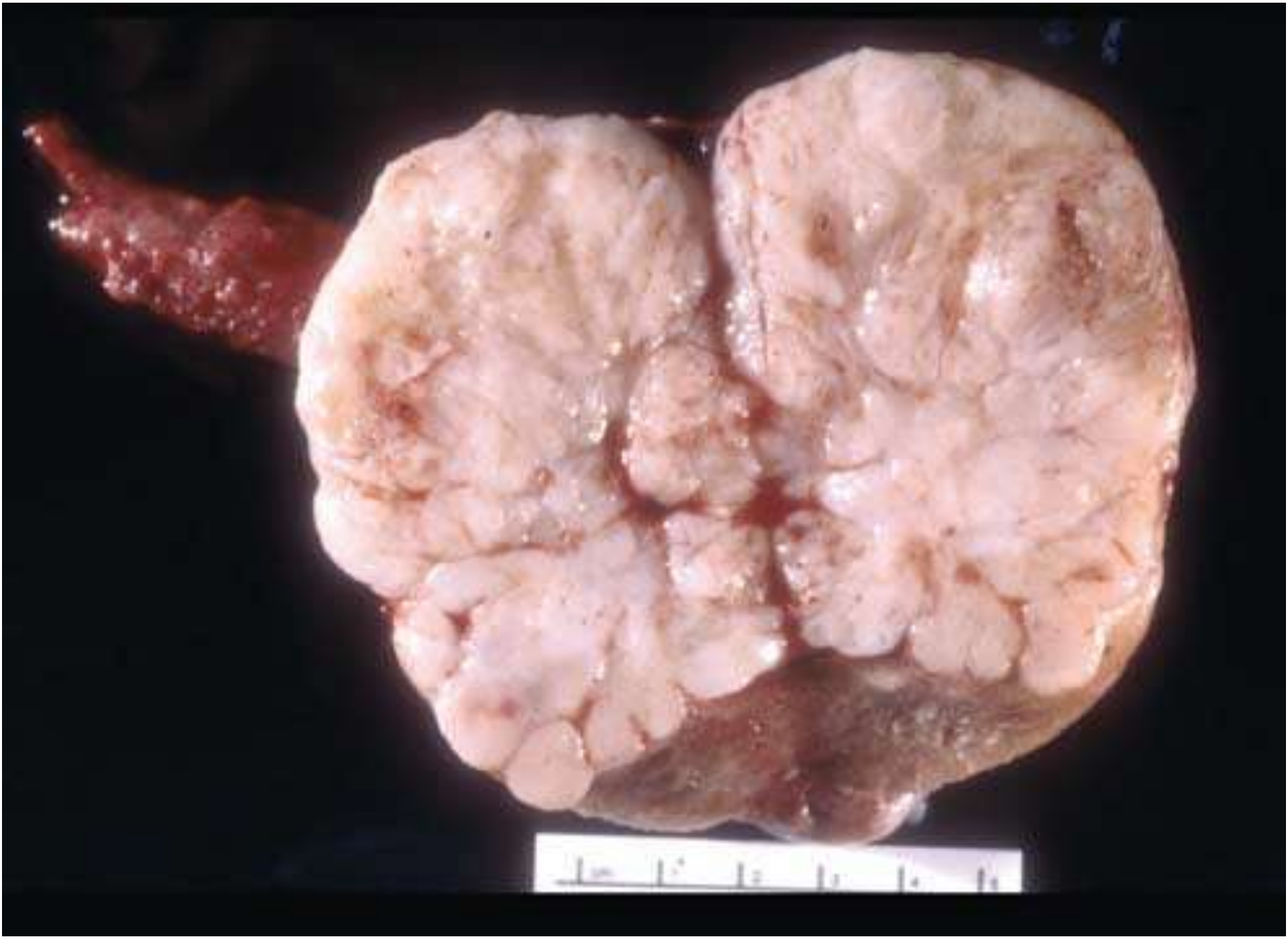
Seminoma arises from spermatogonia in middle and old age, it is the commonest testicular tumor with good prognosis.

Pathological picture

Gross picture:

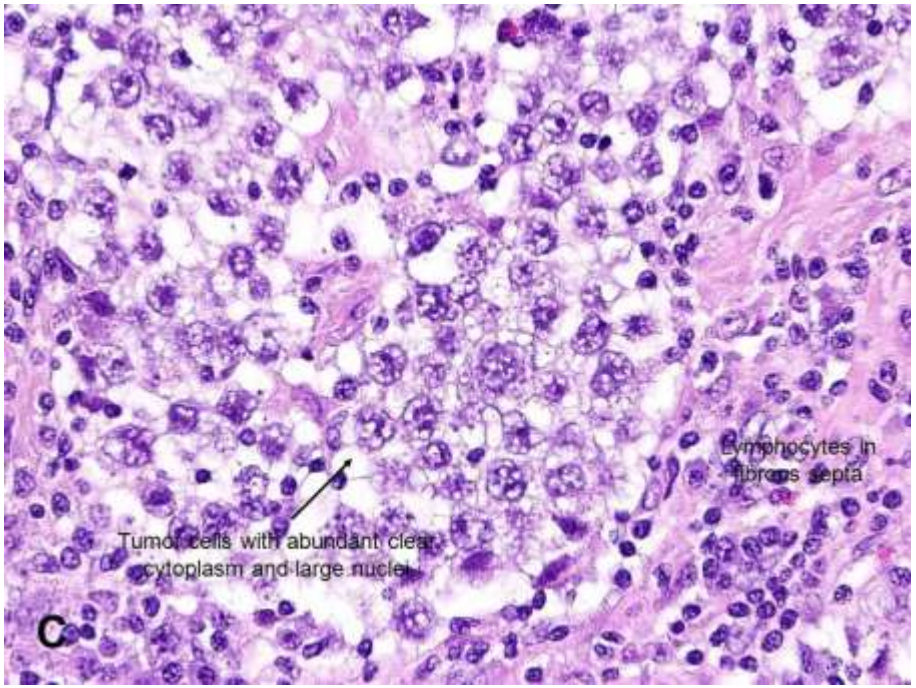
It forms firm greyish-white circumscribed mass usually over 7 cm in diameter replacing all or part of testicular tissue but rarely infiltrate tunica albuginea or epididymis. Haemorrhage and necrosis are unusual.

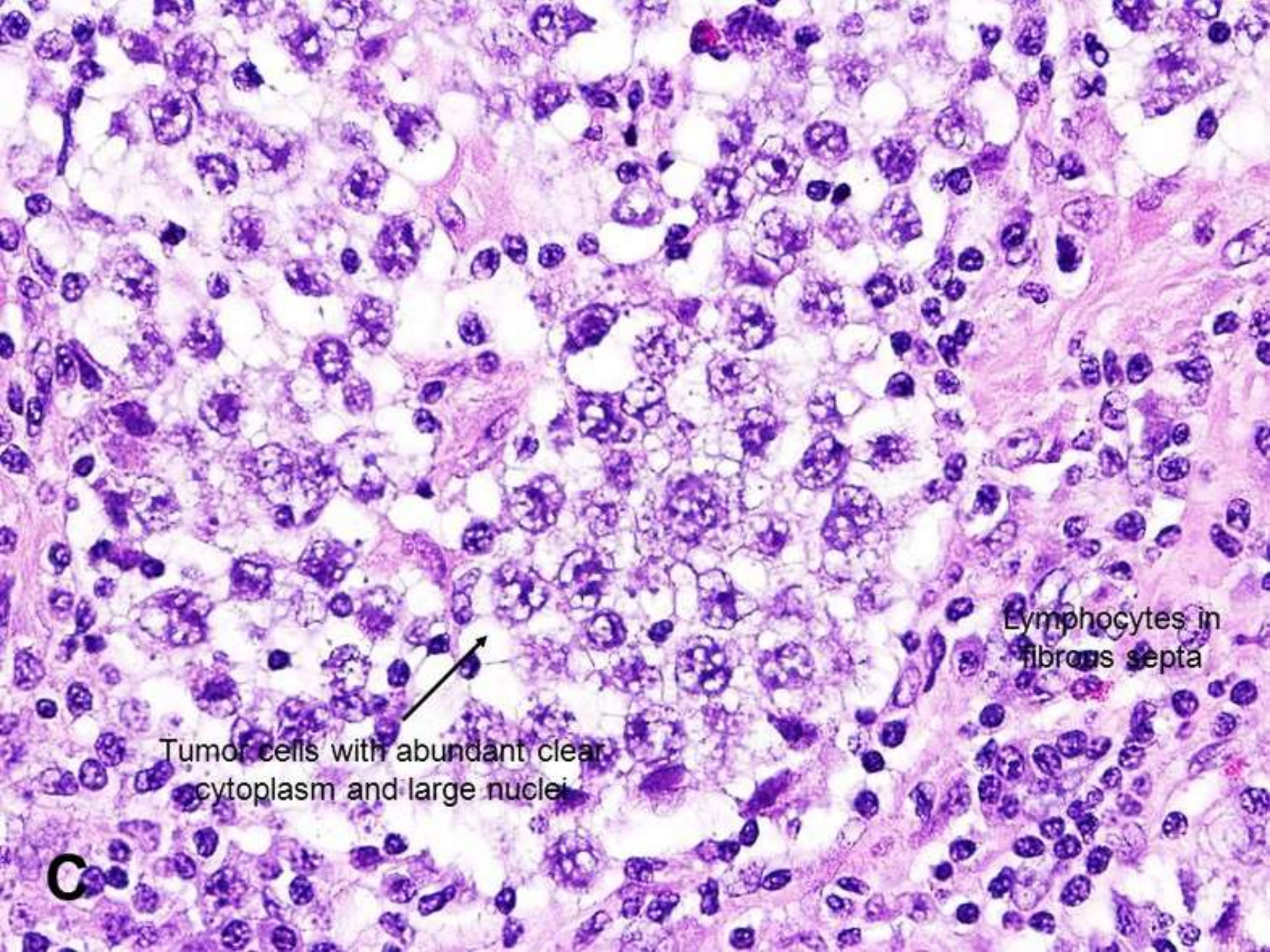




Microscopic picture:

Large rounded or polyhedral cells. the cells has abundant pale cytoplasm, large ronded nuclei and prominent nucleoli. The cells are arranged in solid masses separated by thick fibrous septae infiltrated by lymphocytes. This lymphocytic infiltration is of good prognostic value.




Lymphocytes in fibrous septa
Tumor cells with abundant clear cytoplasm and large nuclei
C

Spread of Seminoma

- **Local spread:** with destruction of the testicular tissue and skin of the scrotum.
- **Lymphatic spread:** to the iliac, para-aortic and mediastinal lymph nodes.
- **Blood spread:** to the lung, liver, bone.


THANK YOU