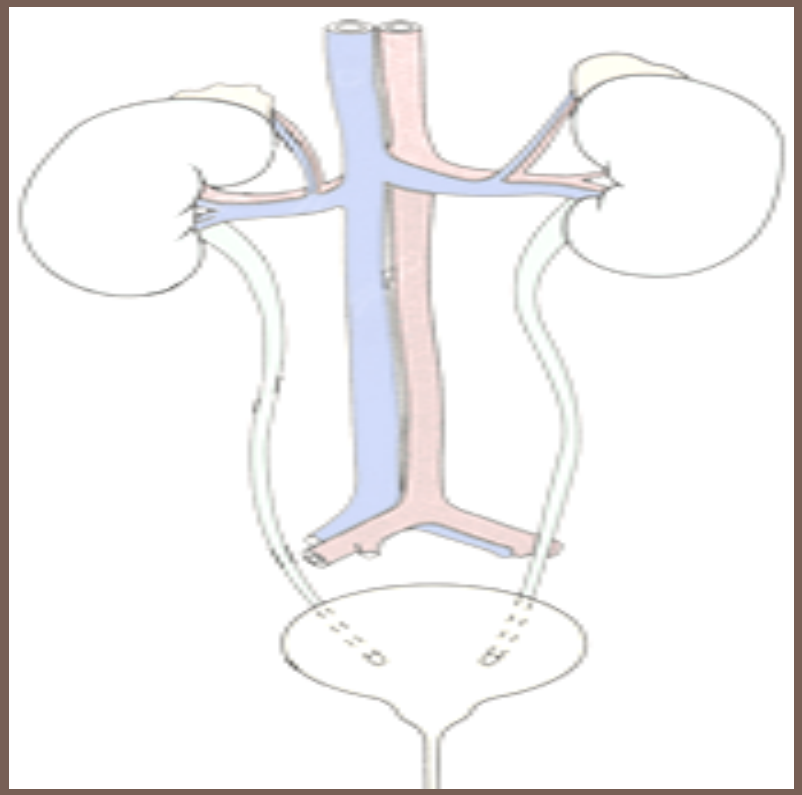
# RENAL BLOCK



## PATHOLOGY PRACTICALS 1 & 2


Prepared by:

- *Prof. Ammar Al Rikabi*
- *Dr. Sayed Al Esawy*

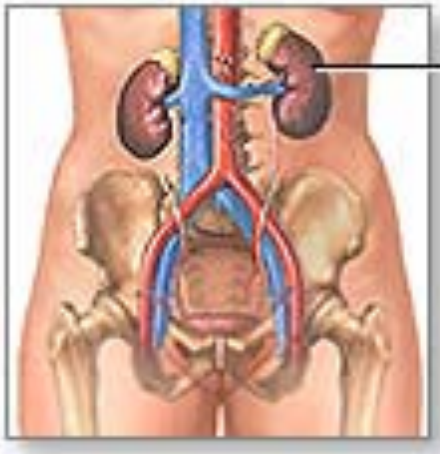
# NORMAL ANATOMY AND HISTOLOGY

# Objectives:

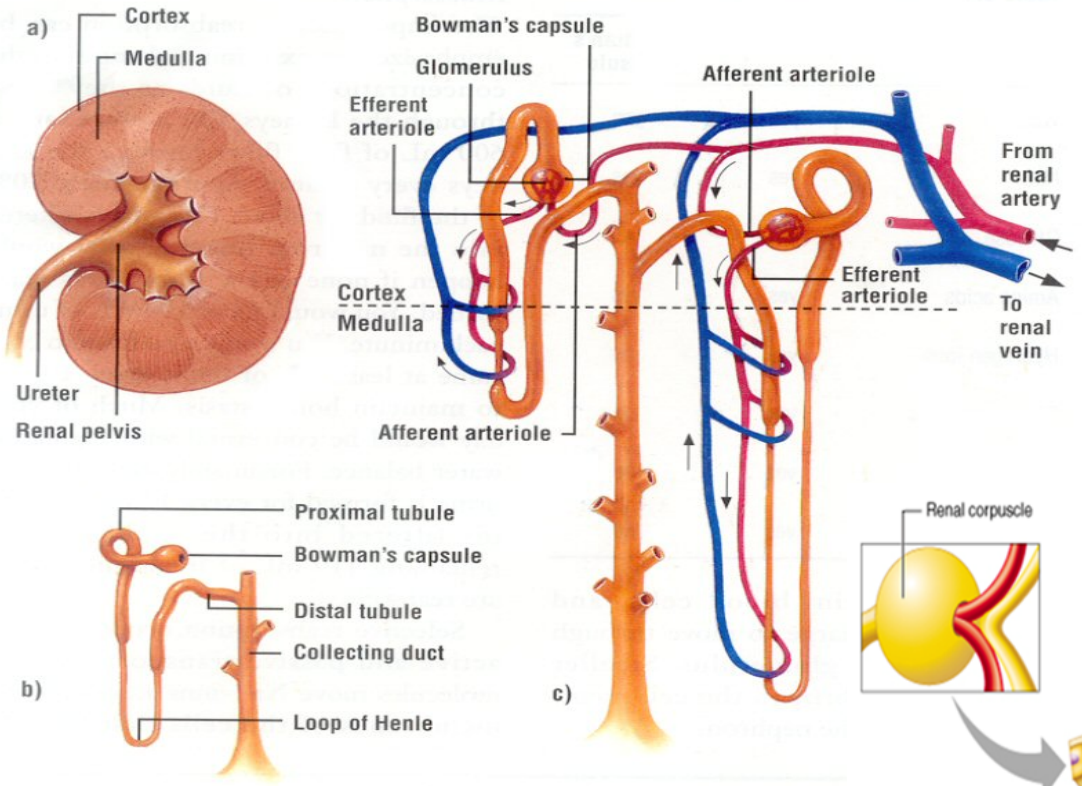
At the end of the practical sessions for the renal block, the students will be able to:

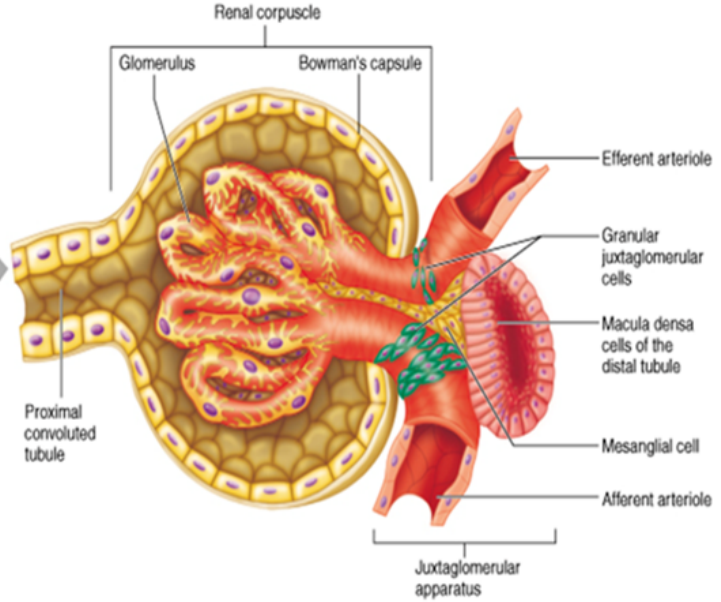
- Describe the normal constituents of the nephron, renal glomeruli and tubules.
- Identify the gross and microscopic features of:
- Practical 1
  - Acute tubular necrosis/injury
  - Autosomal dominant polycystic kidney disease.
- Practical 2
  - Acute pyelonephritis
  - Chronic pyelonephritis
  - Renal stone
  - Hydronephrosis

# Anatomy of the Kidney

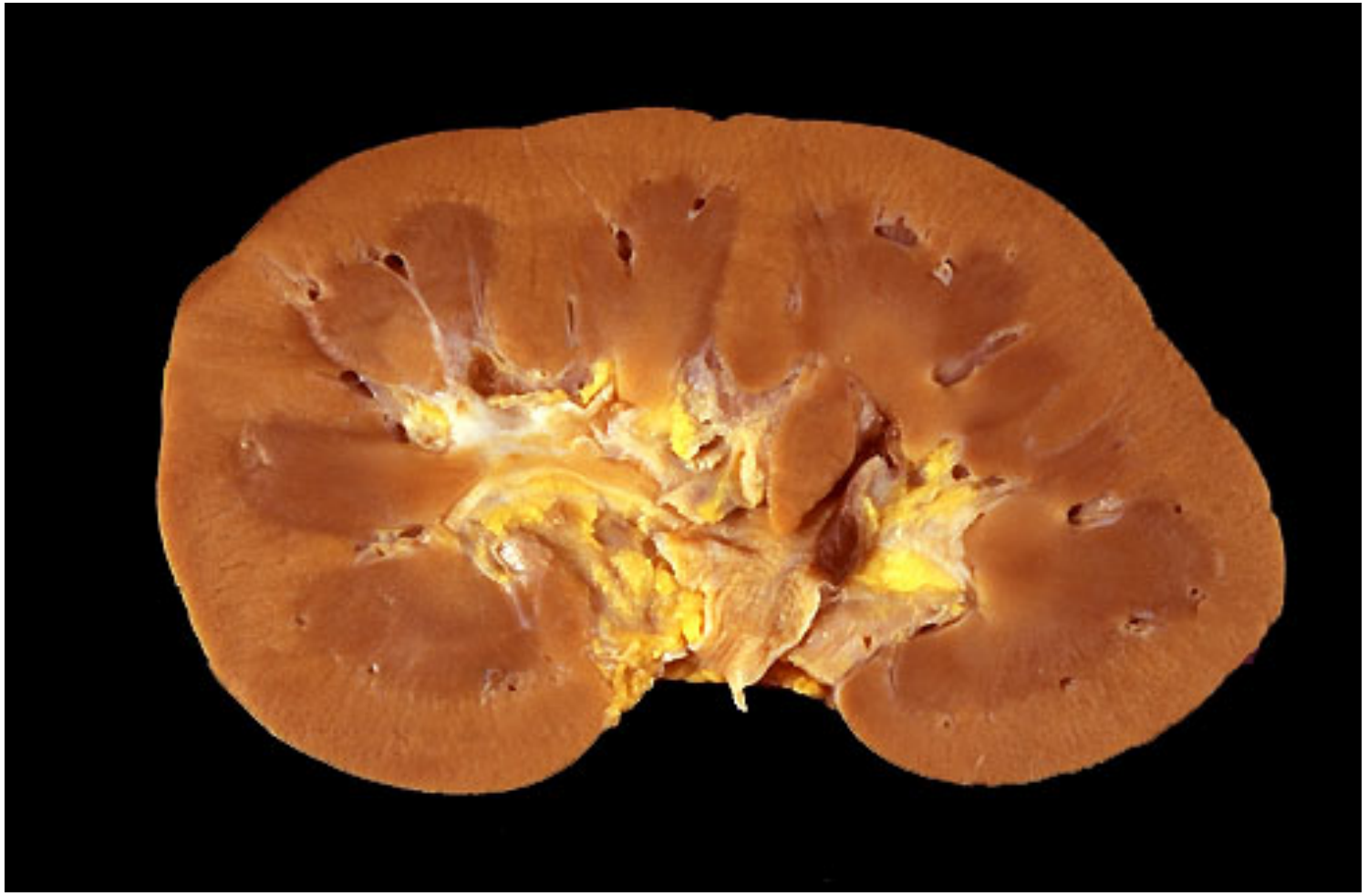


# NEPHRON STRUCTURE



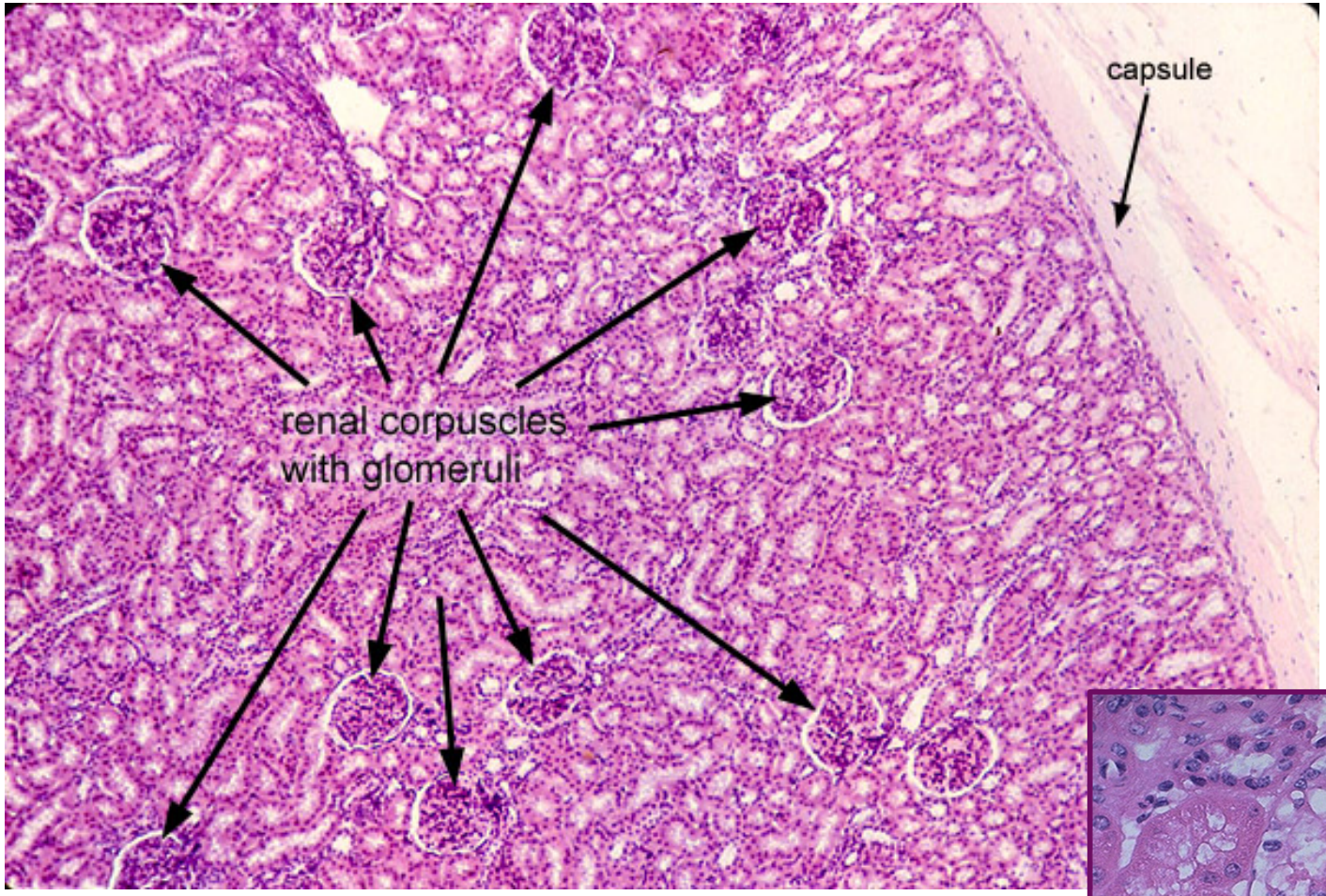



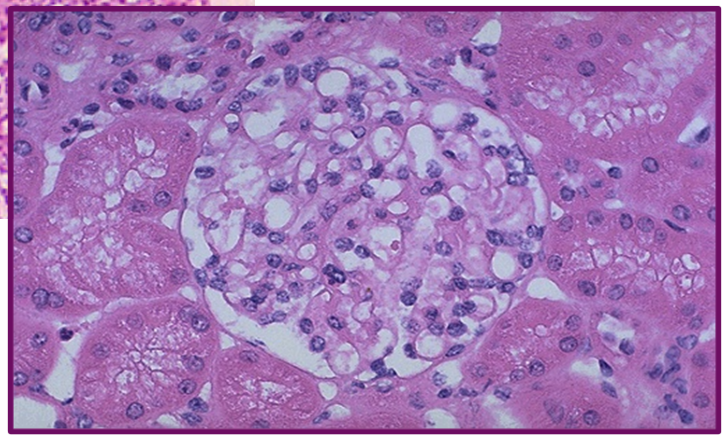
# Normal Kidney - Gross



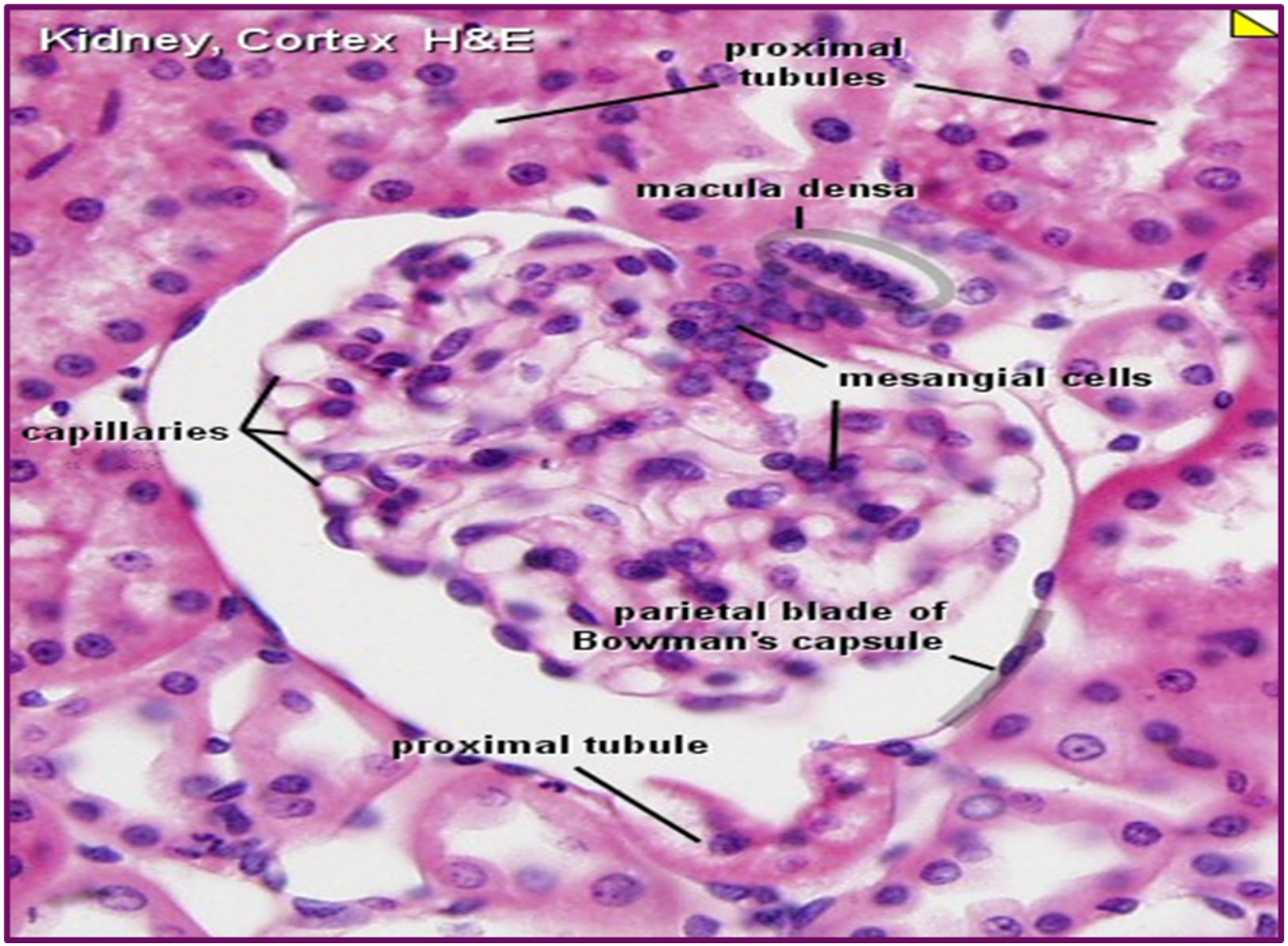
*In cross section, this normal adult kidney demonstrates the lighter outer cortex and the darker medulla, with the renal pyramids into which the collecting ducts coalesce and drain into the calyces and central pelvis.*

# Kidney – Normal Histology



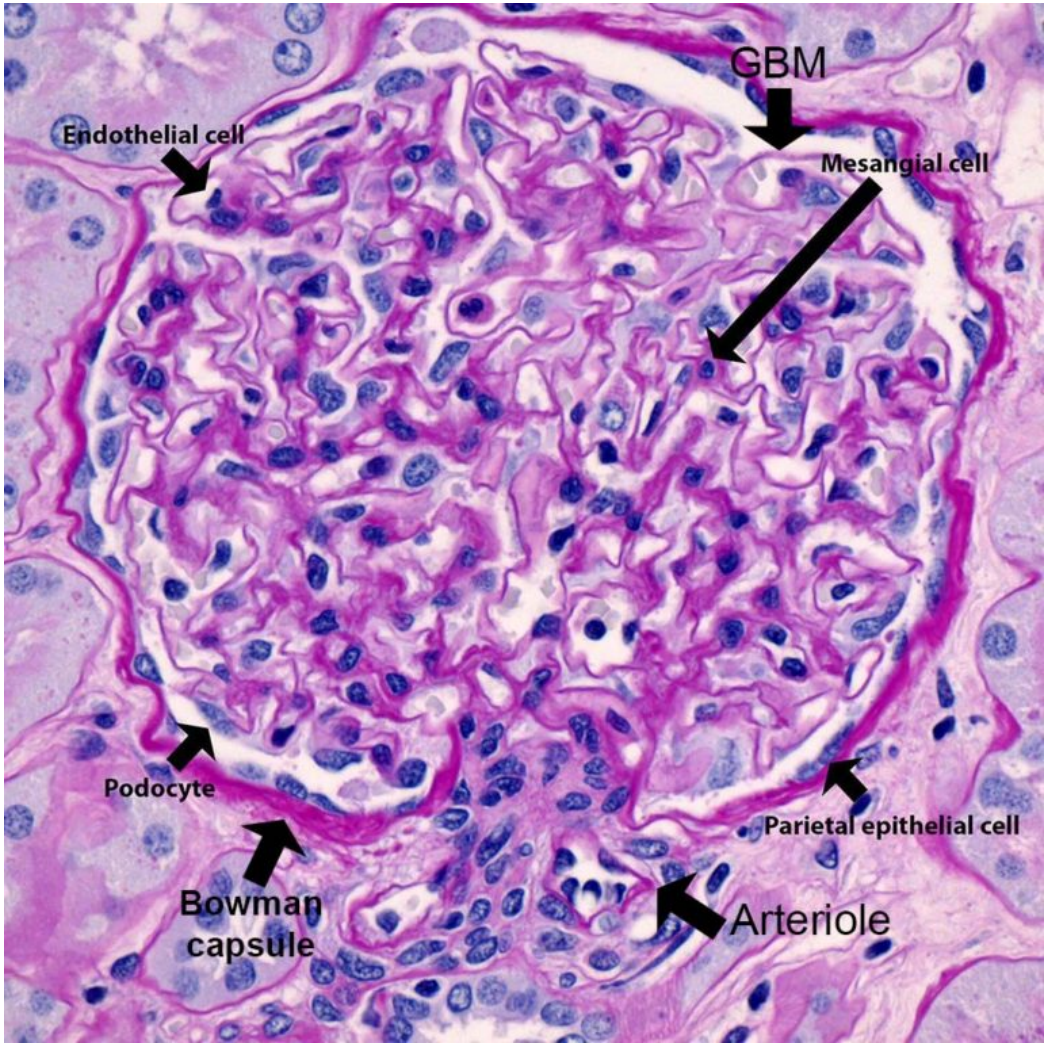



# Renal Corpuscle – Normal Histology




*Normal glomerulus by light microscopy. The glomerular capillary loops are thin and delicate. Endothelial and mesangial cells are normal in number. The surrounding tubules are normal*

# Renal Corpuscle – Normal Histology




***Normal glomerulus is stained with PAS to highlight basement membranes of glomerular capillary loops and tubular epithelium.***

# PRACTICAL SESSION: 1

**Acute tubular necrosis**

**Autosomal dominant polycystic kidney disease**

# Acute tubular injury/ necrosis

# Acute Kidney Injury

## Causes:

## Pre-renal

(All those that decrease effective blood flow to the kidney)

- *Low blood volume, low blood pressure, and heart failure.*
- *Renal artery stenosis, and renal vein thrombosis.*
- *Renal ischemia.*

## Renal:

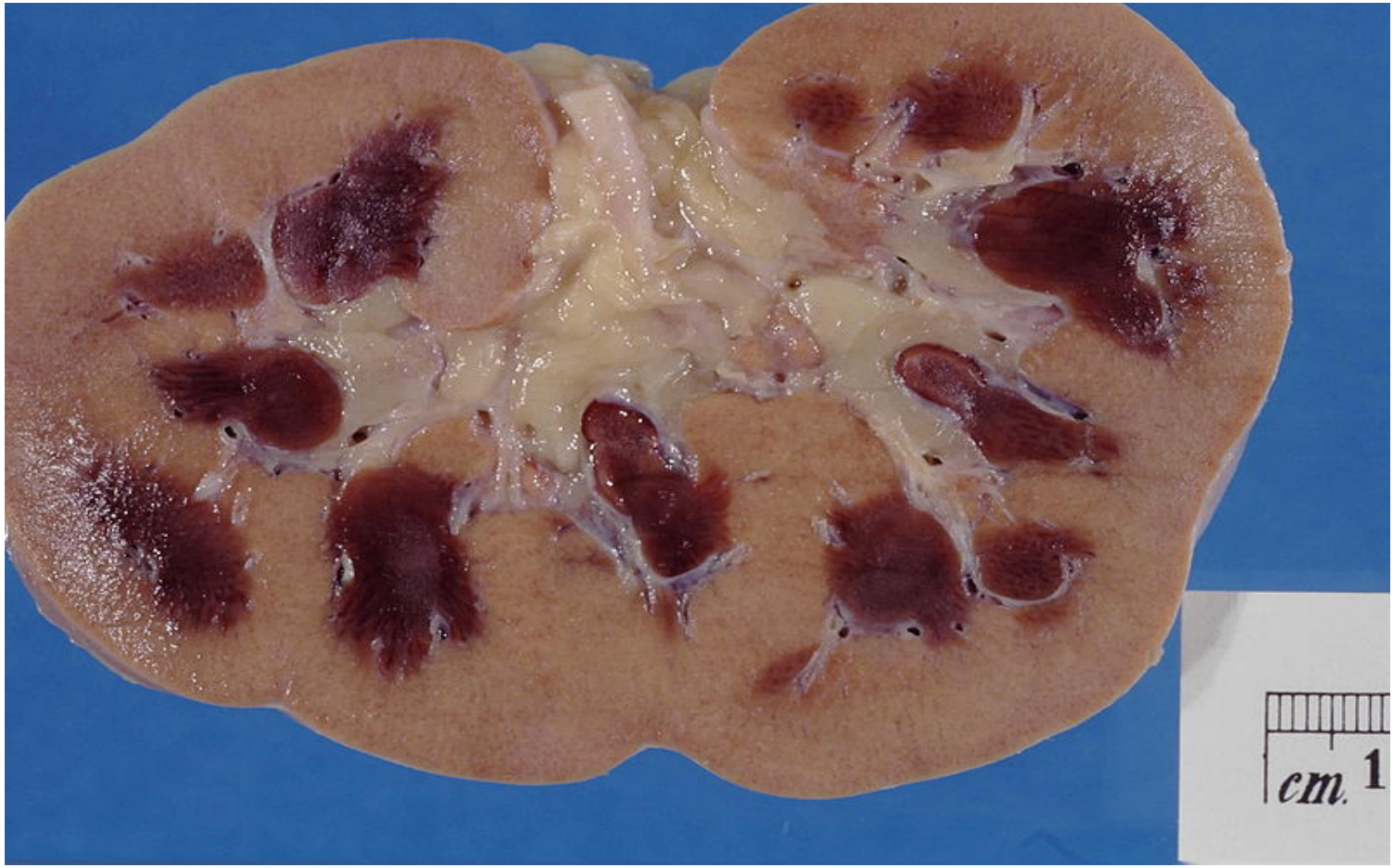
- *Glomerulonephritis (GN).*
- *Acute tubular necrosis (ATN).*
- *Acute interstitial nephritis (AIN).*

## Post-renal:

(is a consequence of urinary tract obstruction)

- *Benign prostatic hyperplasia.*
- *Kidney stones.*
- *Obstructed urinary catheter.*
- *Bladder stone .*
- *Bladder, ureteral or renal malignancy.*

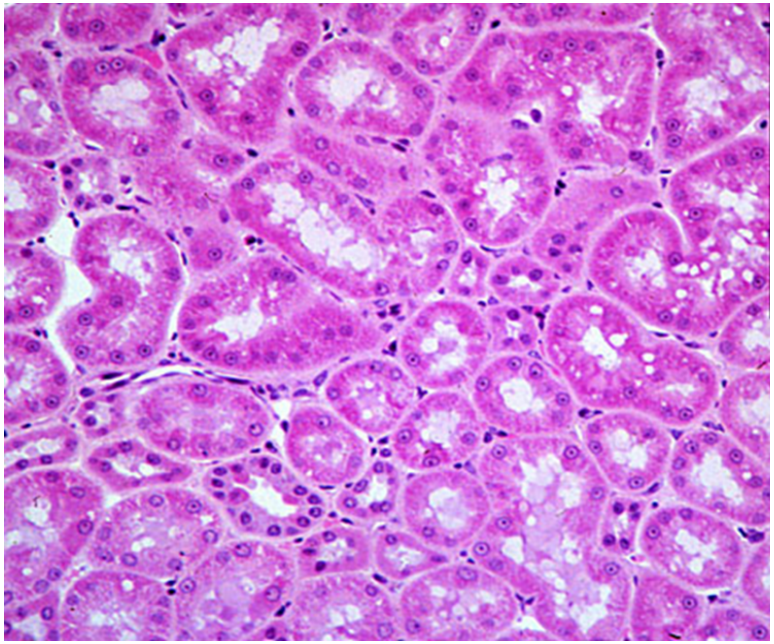
# Acute Kidney Injury



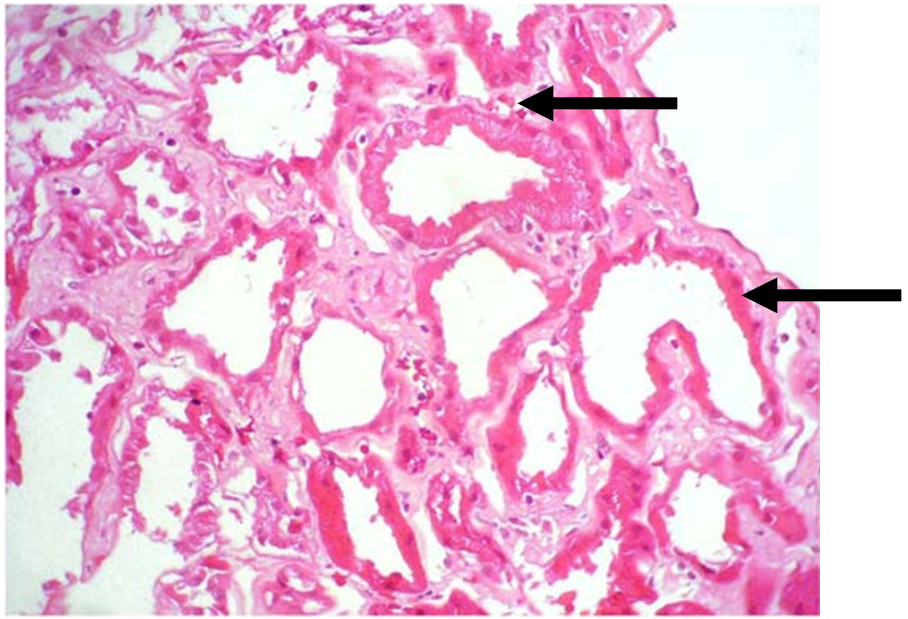

*Kidney showing marked pallor of the cortex, contrasting to the darker areas of surviving medullary tissue.*

# Acute Tubular Necrosis

## Normal tubule

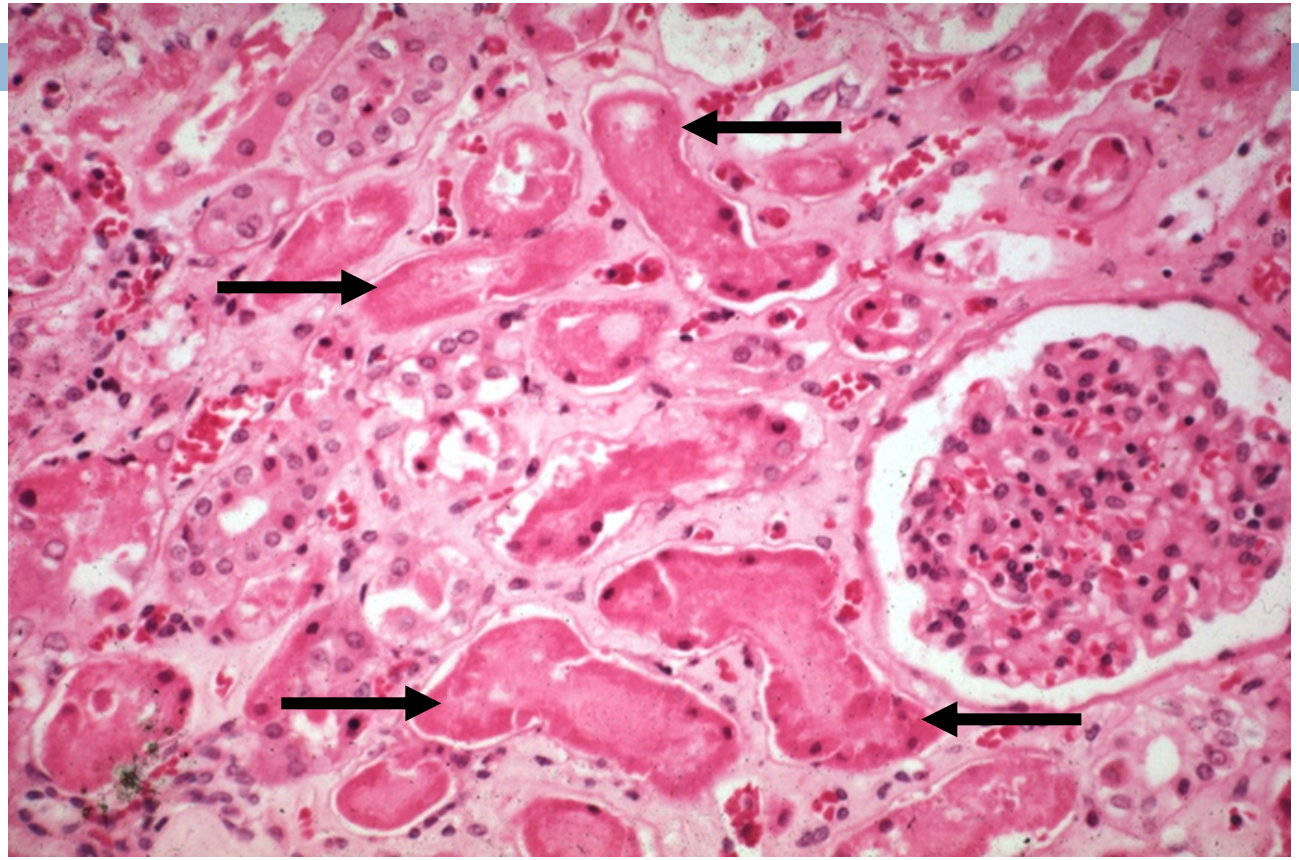


## *Acute tubular necrosis*



***Acute tubular necrosis shows irregularly shaped tubules lined by necrotic and flattened tubular epithelial cells (arrows). The intervening interstitium is edematous.***

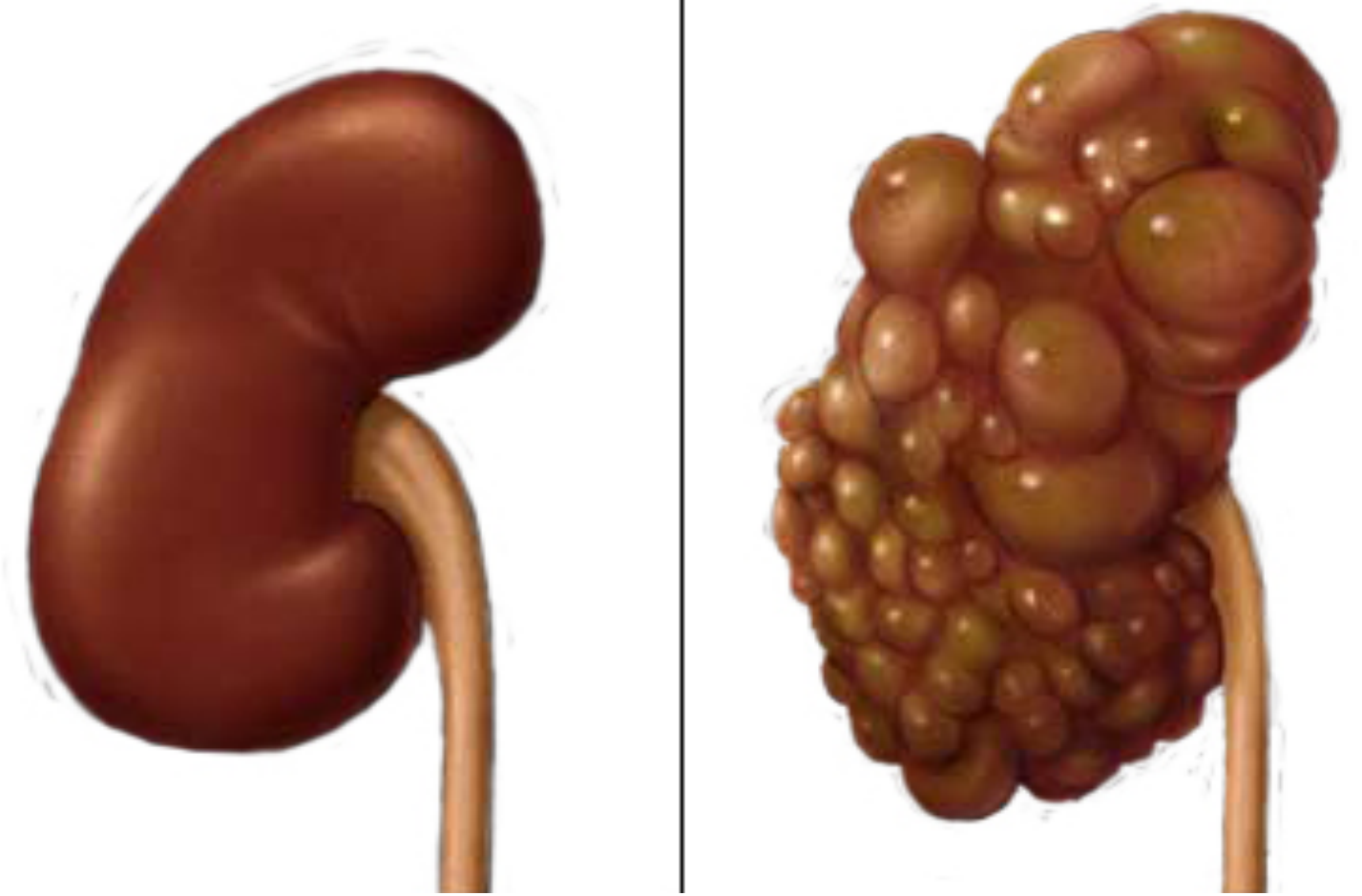
# Acute Tubular Necrosis



*Acute tubular necrosis shows irregularly shaped tubules lined by necrotic tubular epithelial cells (arrows). The nucleus of the tubular cells is lost and ghost outline of cells remain. The intervening interstitium is edematous.*

# POLYCYSTIC KIDNEY

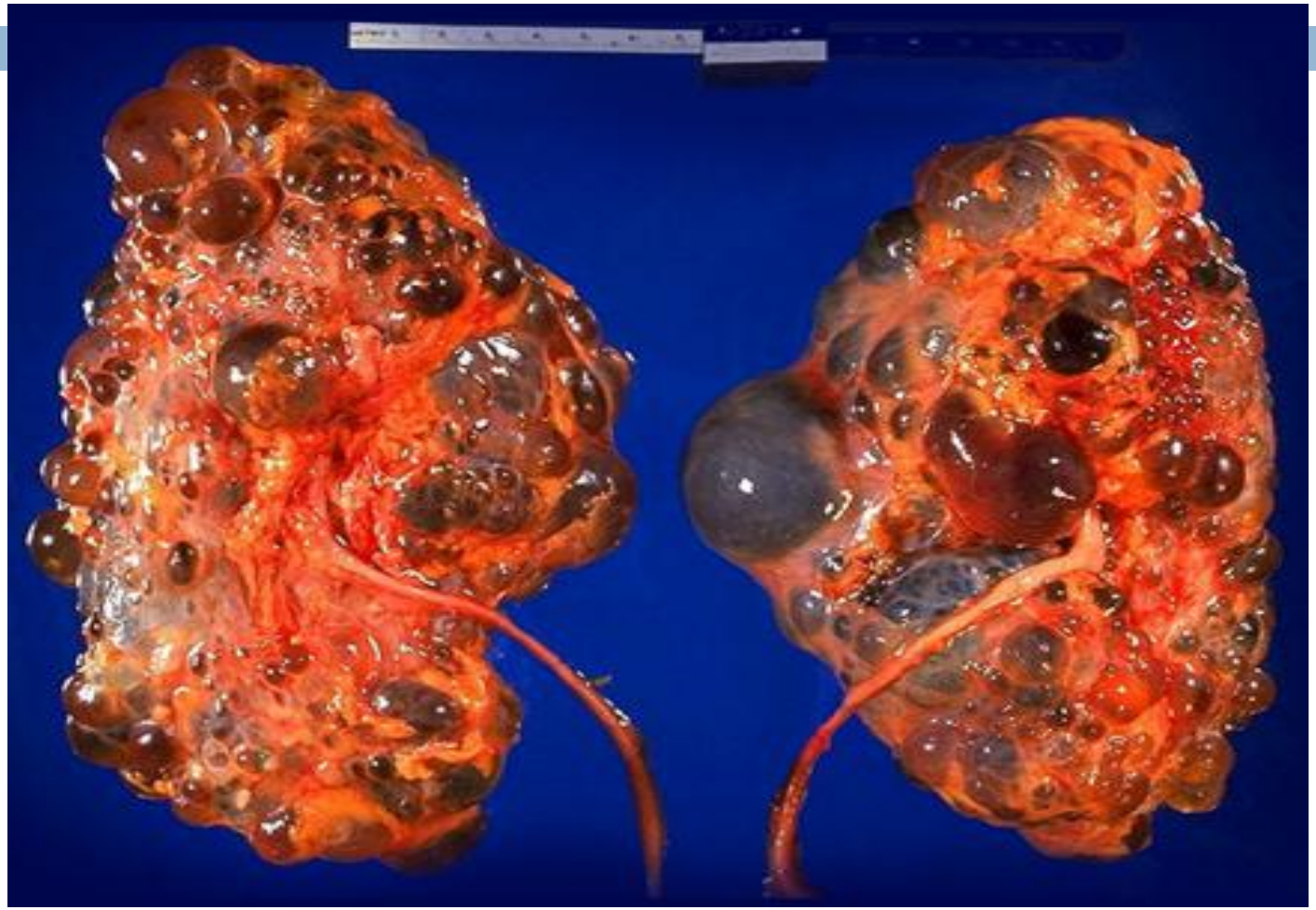
# Normal vs Polycystic Kidney



# Autosomal Dominant (Adult) Polycystic Kidney Disease

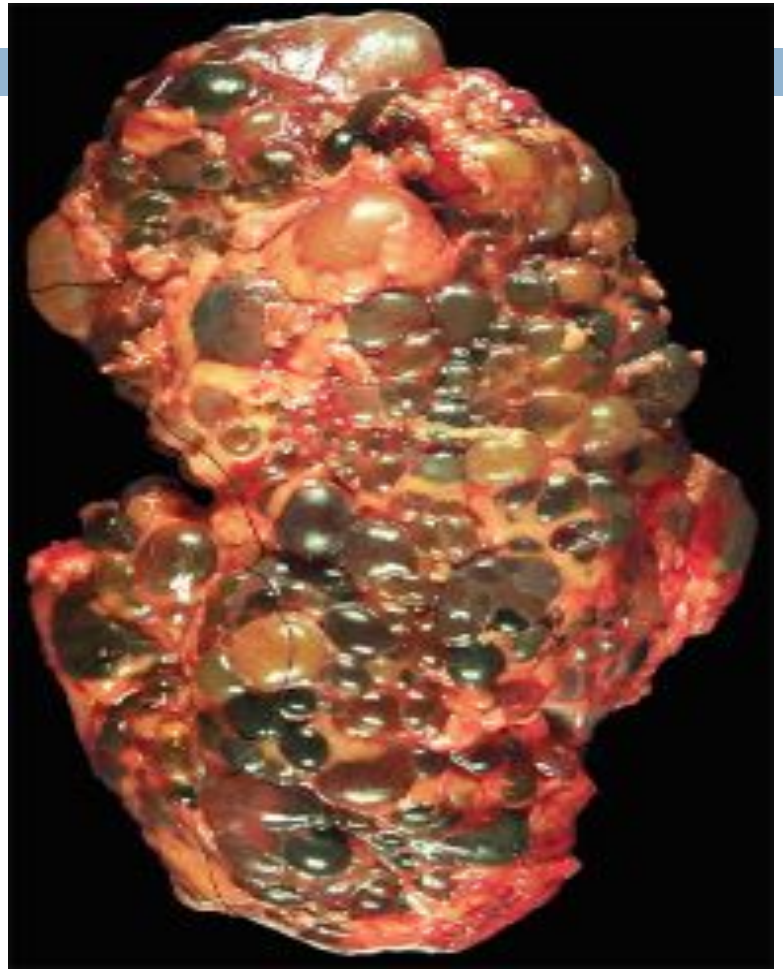
- Autosomal Dominant (Adult) Polycystic Kidney Disease is a disease of autosomal dominant inheritance caused by mutations in the genes encoding polycystin-1 or -2. It accounts for about 10% of cases of chronic renal failure.
- It usually produces symptoms by the fourth decade of life, by which time the kidneys are quite large (the cysts start to develop in adolescence).
- Common clinical features
  - flank pain or a heavy, dragging sensation
  - Intermittent gross hematuria
  - palpable abdominal mass.
- Complications of adult polycystic kidney
  - acute distention of a cyst, intracystic hemorrhage.
  - urinary infection.
  - Hypertension.
  - Saccular aneurysms of the circle of Willis are present in 10% to 30% of patients and they can rupture → subarachnoid hemorrhage.
  - Renal failure/uremia (end-stage kidney disease) usually occurs by age 50.
- Patients in whom the disease progresses to renal failure are treated by renal transplantation.
- Death usually results from uremia or hypertensive complications.

# Autosomal Dominant (Adult) Polycystic Kidney Disease – *Gross Anatomy*

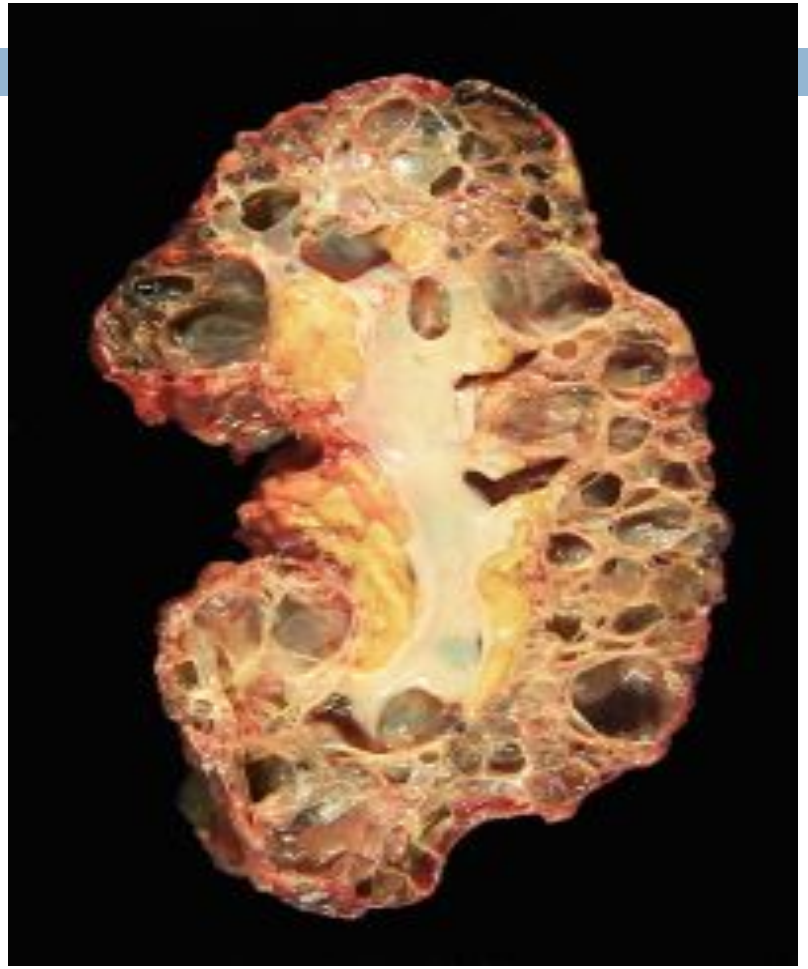


***Bilateral autosomal dominant polycystic kidney disease***
***Markedly enlarged kidney and replacement of the renal parenchyma by numerous cysts of variable sizes***

# *Gross* Autosomal Dominant (Adult) Polycystic Kidney Disease *and its Cut Section*

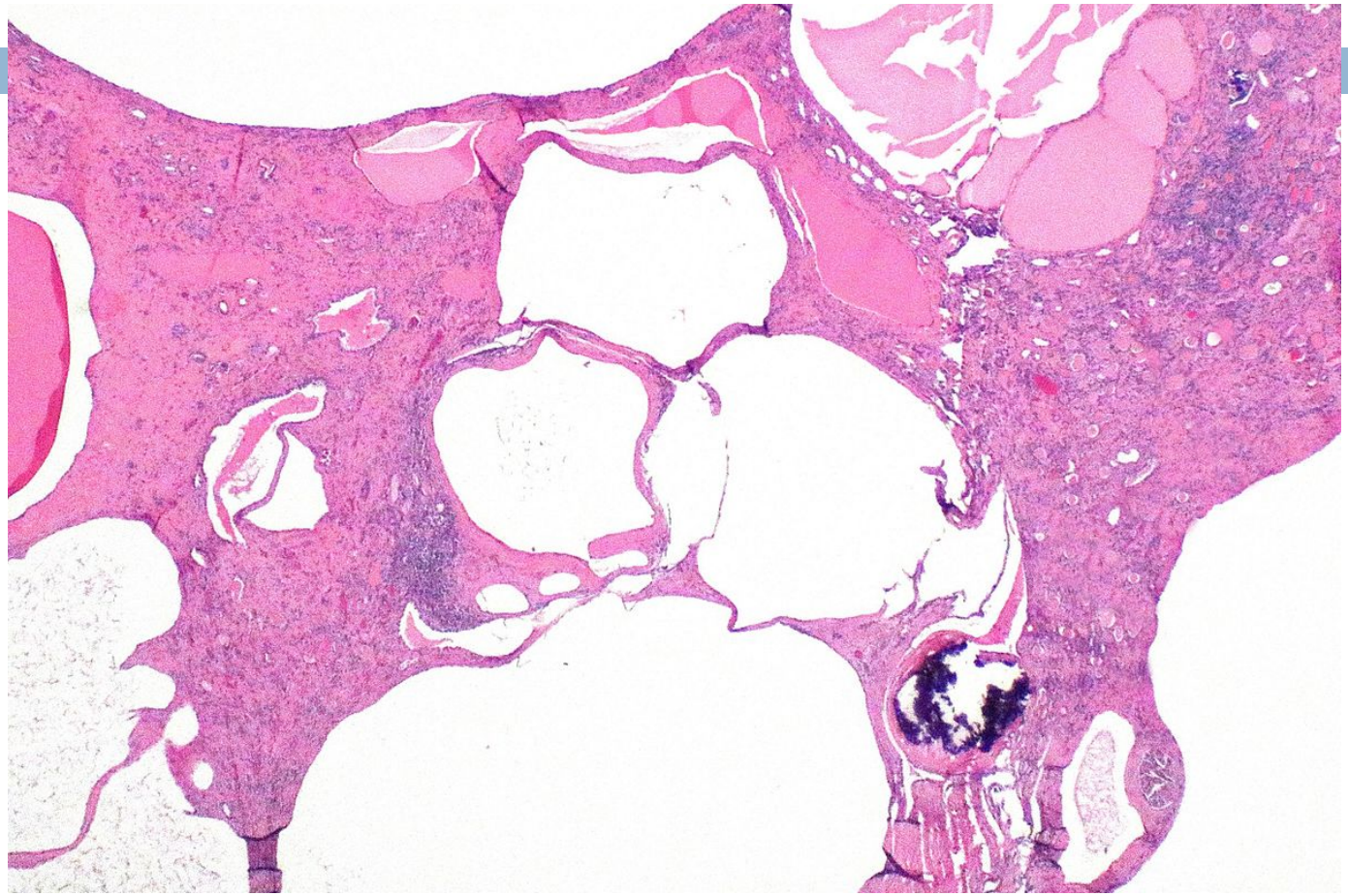


*Massively enlarged kidney disrupted by numerous cysts*



*Cut surface of the kidney, showing extensive cortical destruction by cysts*

# Autosomal dominant polycystic kidney – histopathology



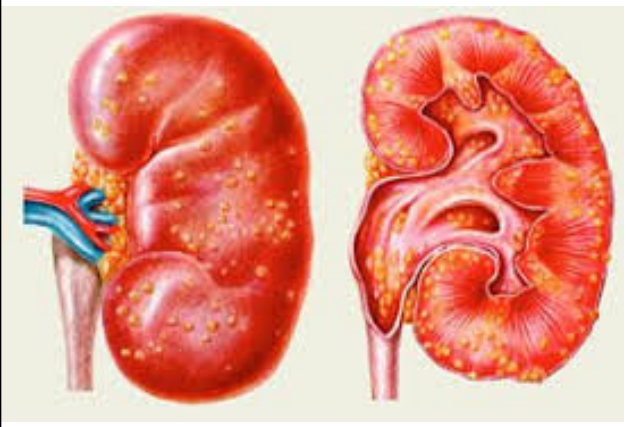
Sections show cortical cysts lined by simple flattened epithelium, with interspersed atrophic renal parenchyma (sclerosed glomeruli, atrophic tubules, interstitial fibrosis) and dystrophic calcification.

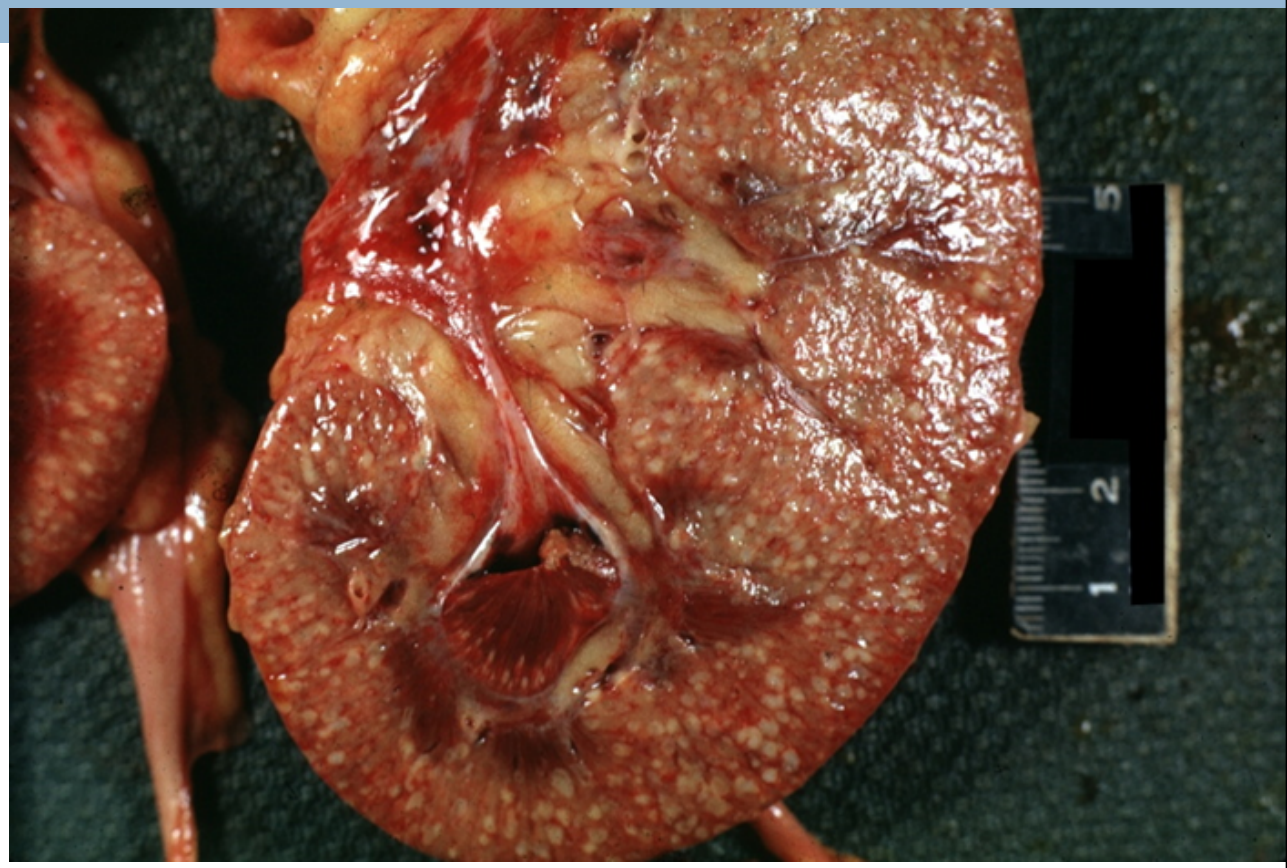
# PRACTICAL SESSION : 2

Acute pyelonephritis
Chronic pyelonephritis
Renal stones
Hydronephrosis

# ACUTE PYELONEPHRITIS

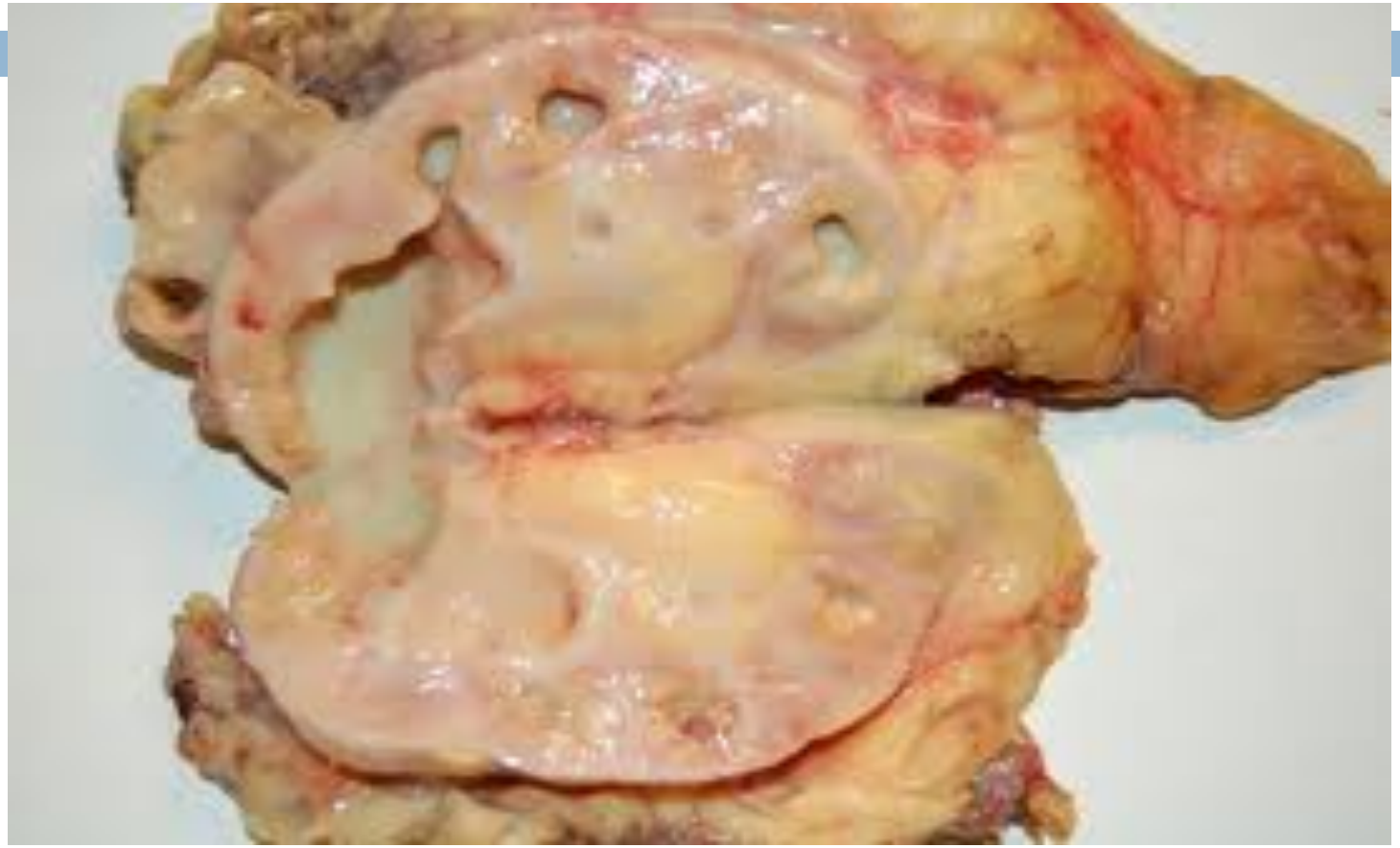
# Acute Pyelonephritis with small cortical abscesses





*Acute Pyelonephritis with small cortical abscesses*

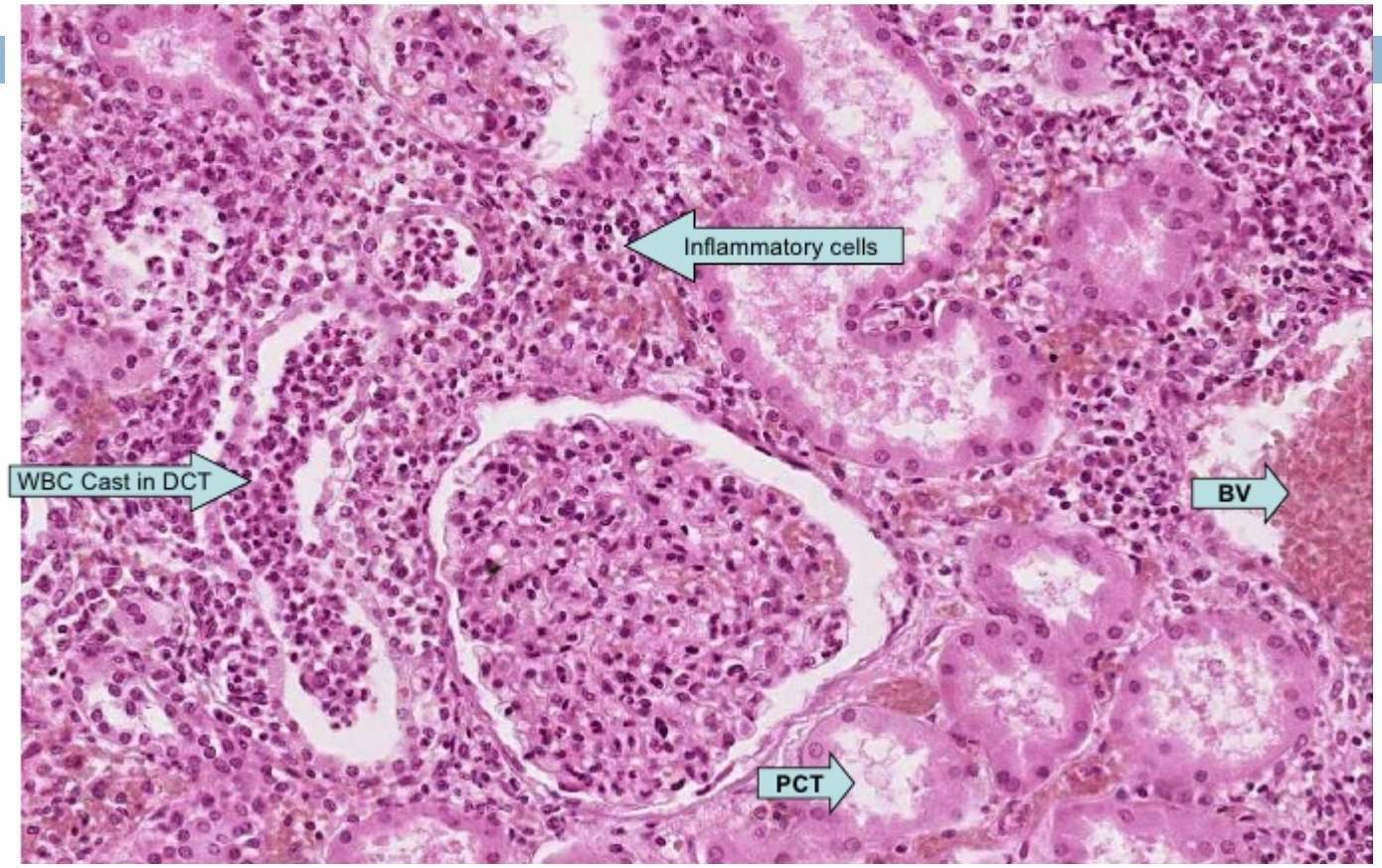
# Classic picture of Acute Pyelonephritis



*This kidney is bisected to reveal a dilated pelvis and calyxes filled with a yellow pus which is consistent with a pyelonephritis. The cortex and medulla are pale and the corticomedullary junction is ill-defined.*

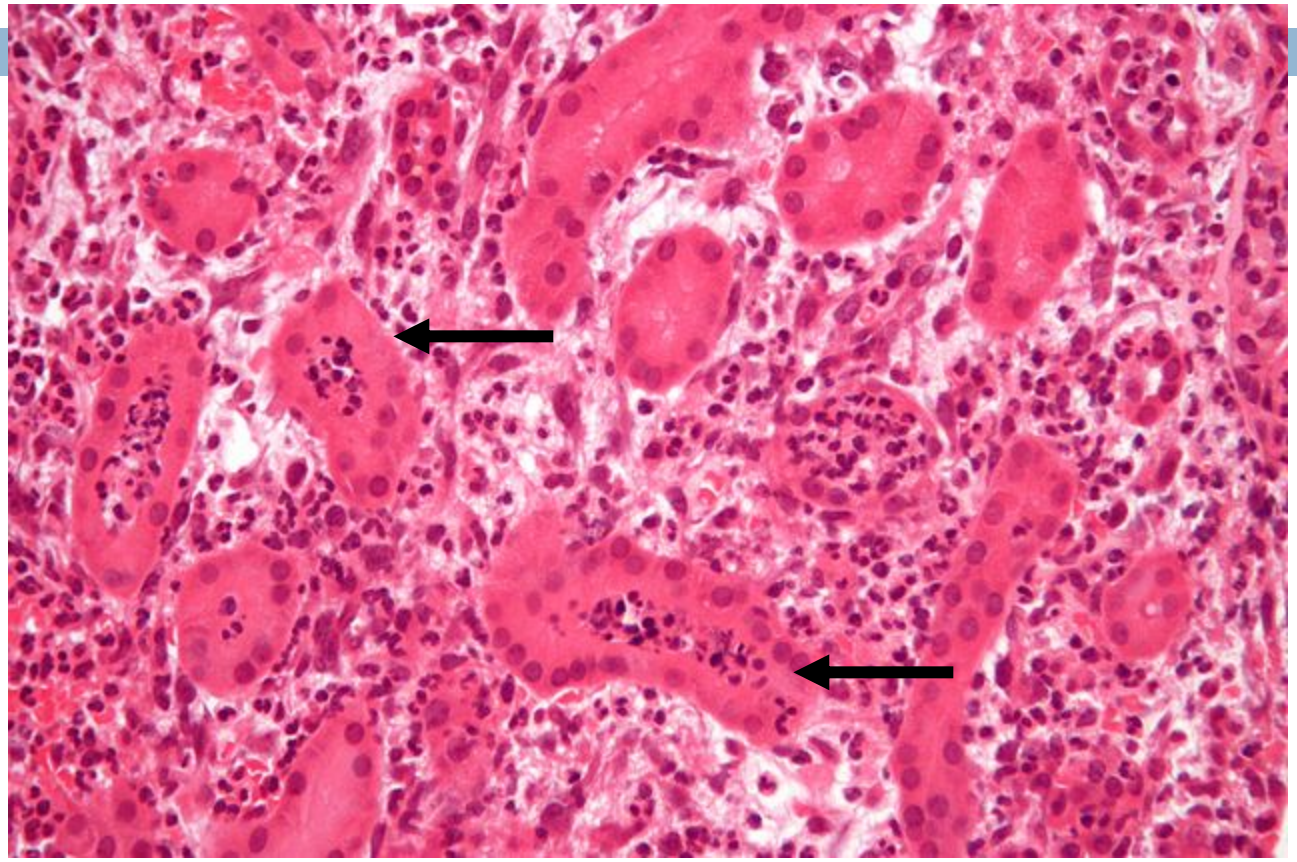
*No tumors are seen.*

# Acute Pyelonephritis - Histopathology




*Acute pyelonephritis is diagnosed by intratubular aggregation of neutrophils. There is surrounding interstitial inflammation with a mixture of inflammatory cells (neutrophils, lymphocytes and plasma cells).*

# Acute Pyelonephritis - Histopathology

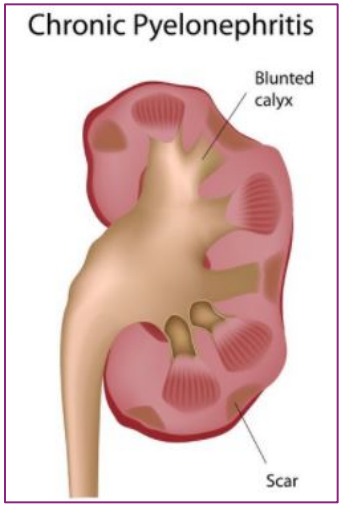


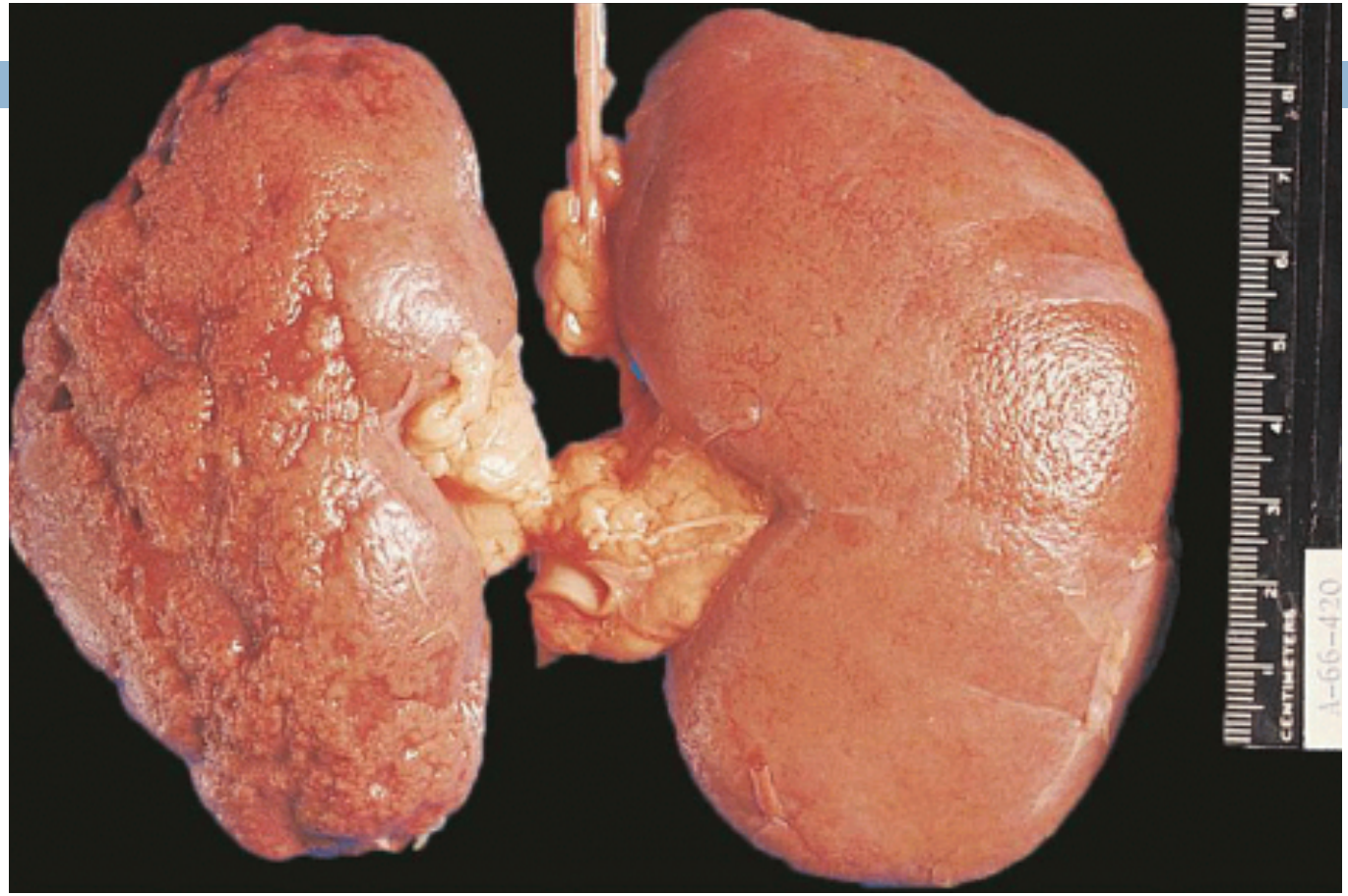
Kidney biopsy. " by Nephron. License: CC BY-SA 3.0

***Neutrophilic aggregates are seen in the lumen of renal tubules (arrows). These leukocytes may form into a cast within the tubule which are passed out in the urine.***

# CHRONIC PYELONEPHRITIS

# Chronic Pyelonephritis - Gross Pathology



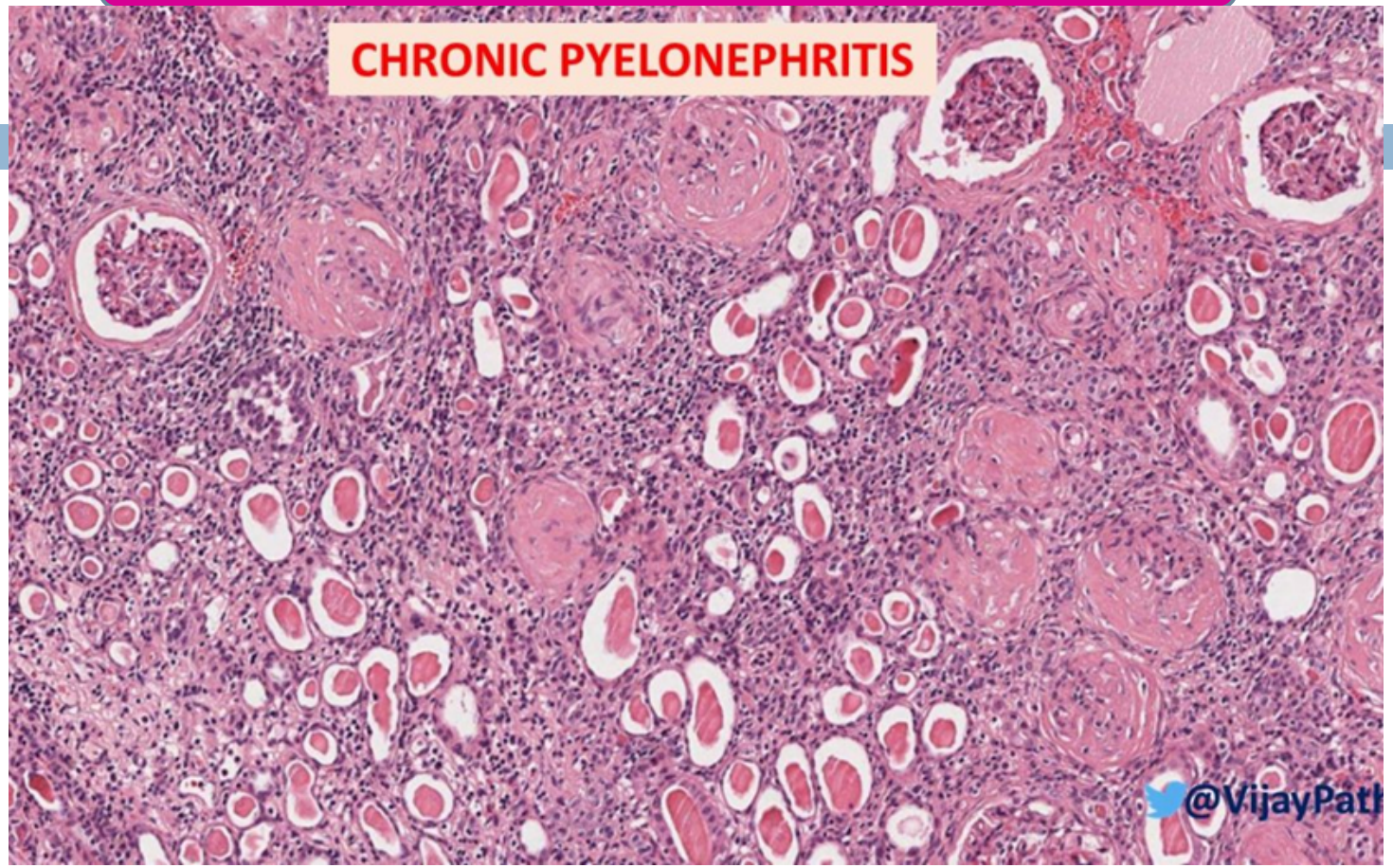
https://abdominalkey.com/wp-content/uploads/2016/06/C24-FF16.gif

***The most common causes are:***

- ***Obstruction by renal stones and others.***
- ***Reflux uropathy – urinary reflux.***
- ***Drugs like NSAID's, methicillin etc.***
- ***Recurrent urinary tract infections.***

***The picture shows slightly atrophic and deformed kidney with irregular, coarse, depressed scars on the cortical surface of the left kidney. The right kidney appears normal with smooth surface.***

# Chronic Pyelonephritis - Histopathology

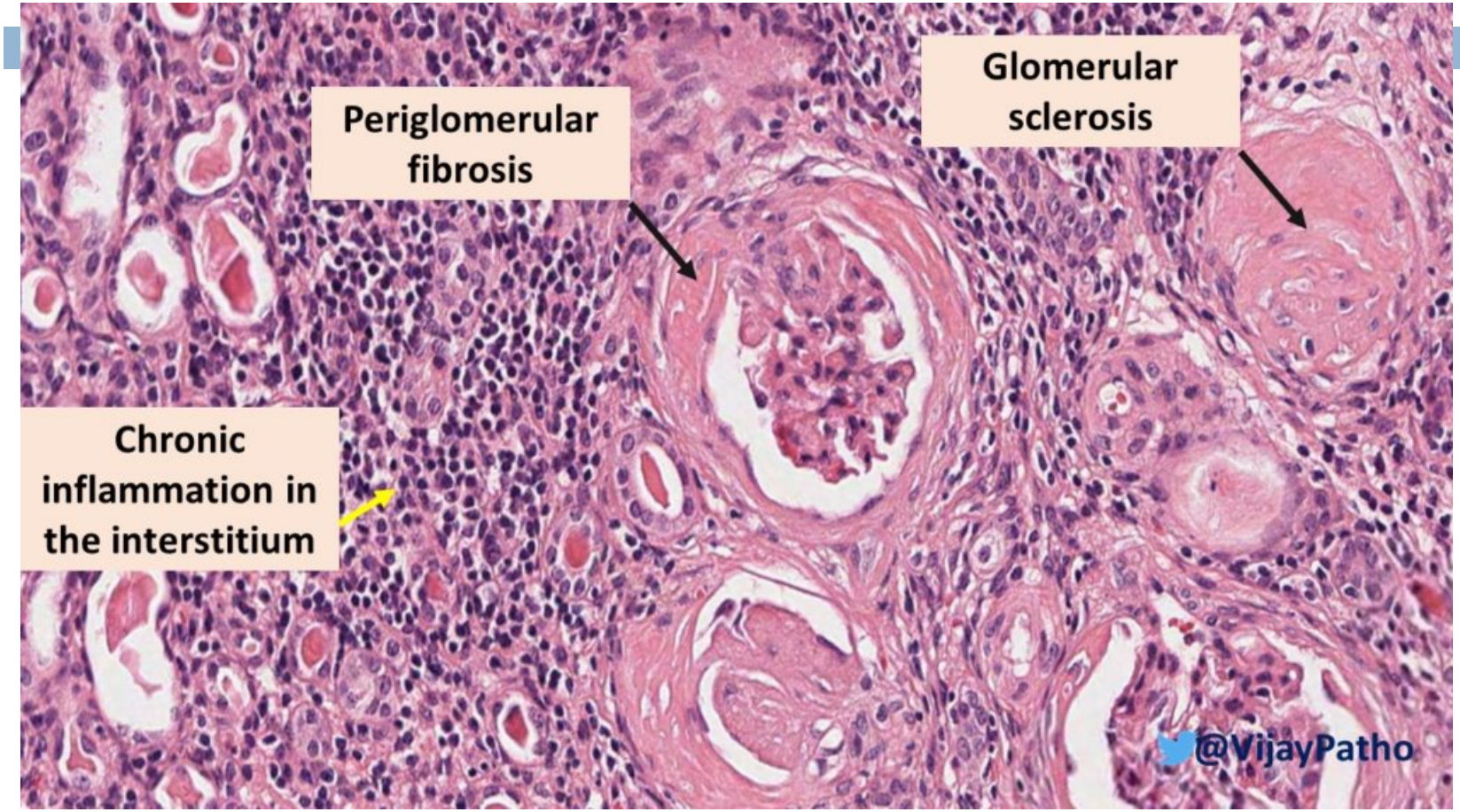



*In chronic pyelonephritis:*

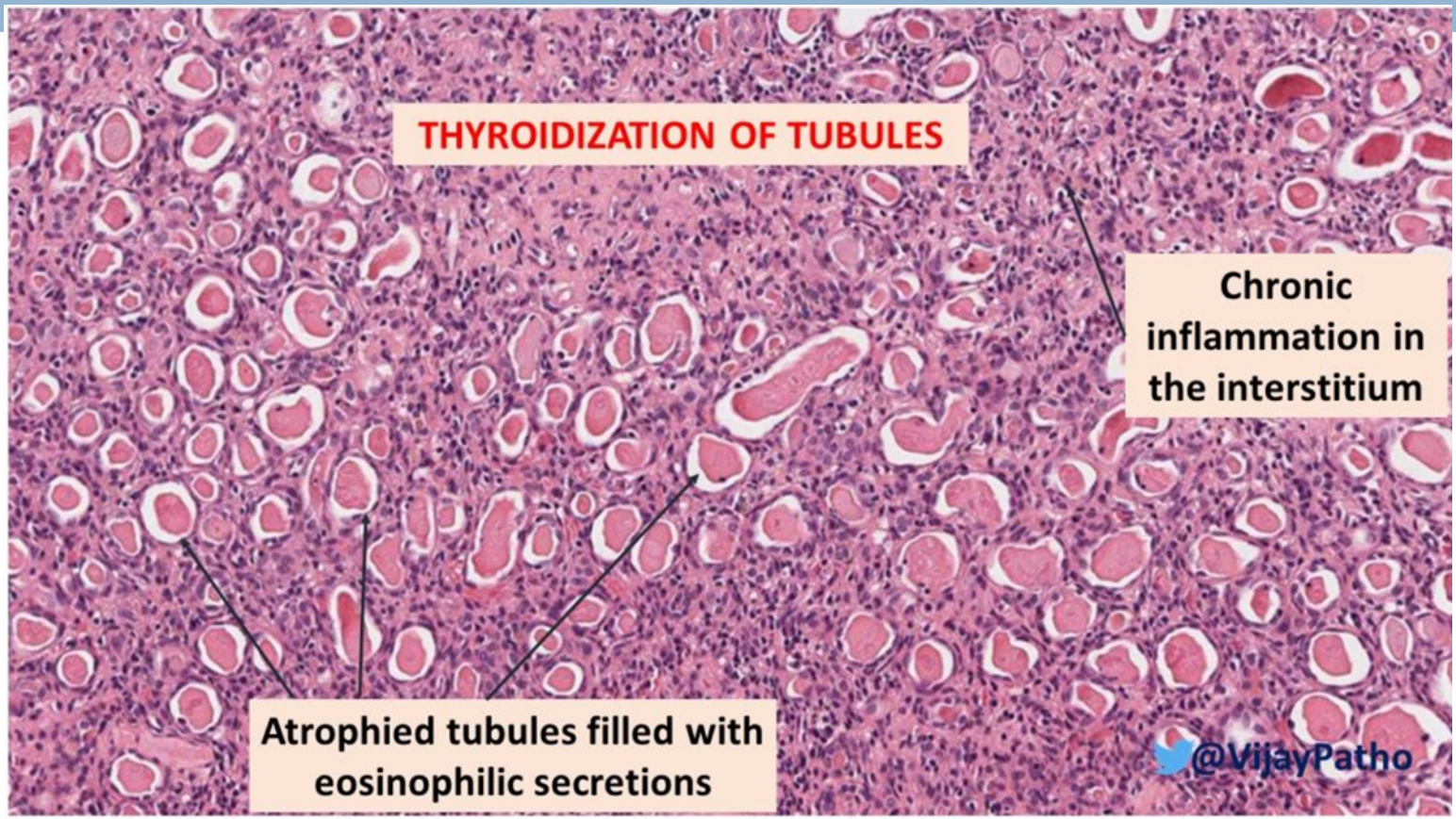
- *Tubules → tubular atrophy with thyroidization of tubules(tubules are filled with eosinophilic hyaline casts resembling colloid of thyroid gland).*
- *Interstitium → interstitial fibrosis and chronic interstitial inflammation (lymphocytes and plasma cells)*
- *Glomeruli → periglomerular fibrosis and glomerulosclerosis*

*Chronic pyelonephritis ultimately can lead to renal failure /end stage renal disease).*

# Chronic Pyelonephritis - Histopathology



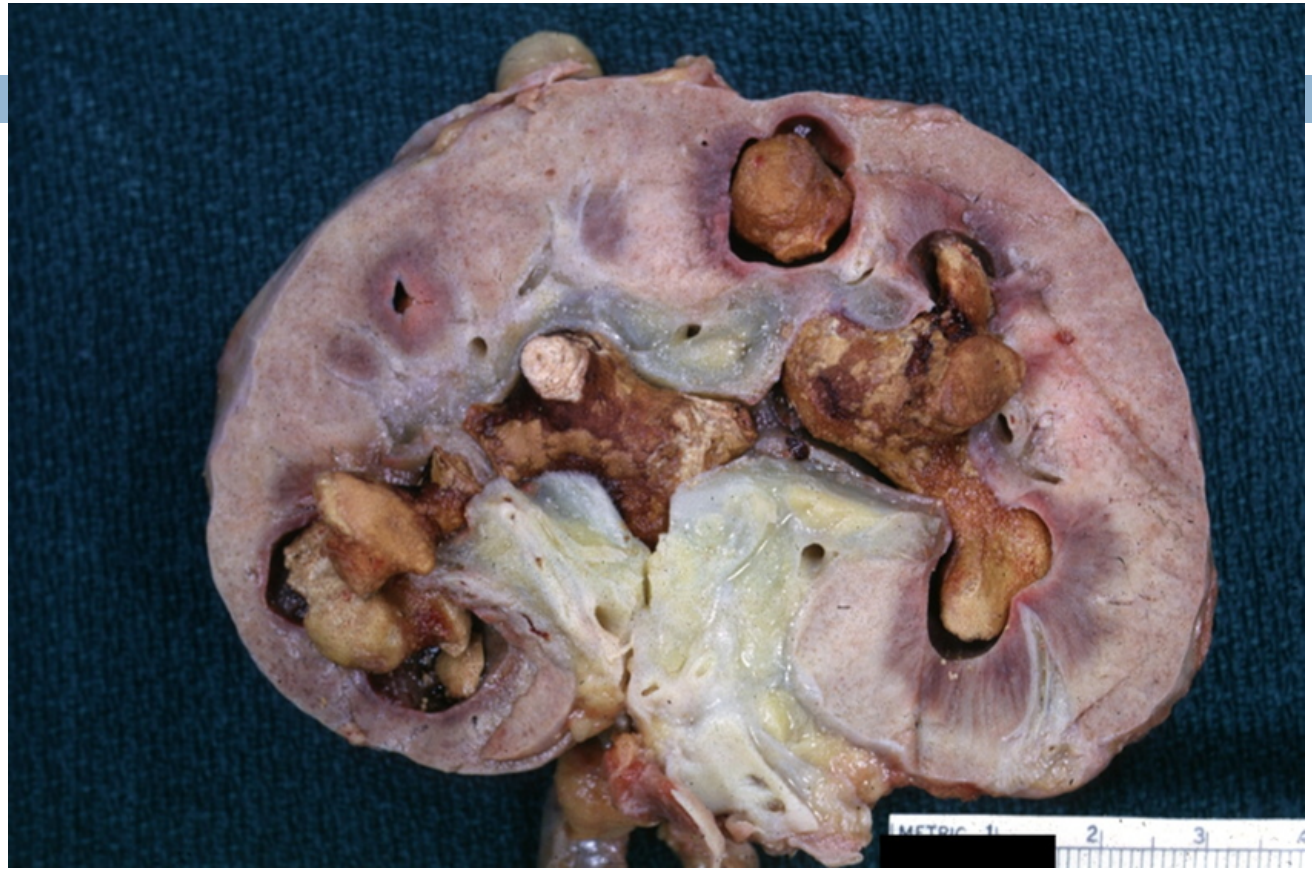
# Chronic Pyelonephritis - Histopathology




- Periglomerular fibrosis & glomerulosclerosis.
- Chronic interstitial inflammation.
- Thyroidization and atrophy of renal tubules.

# Nephrolithiasis (renal stones)

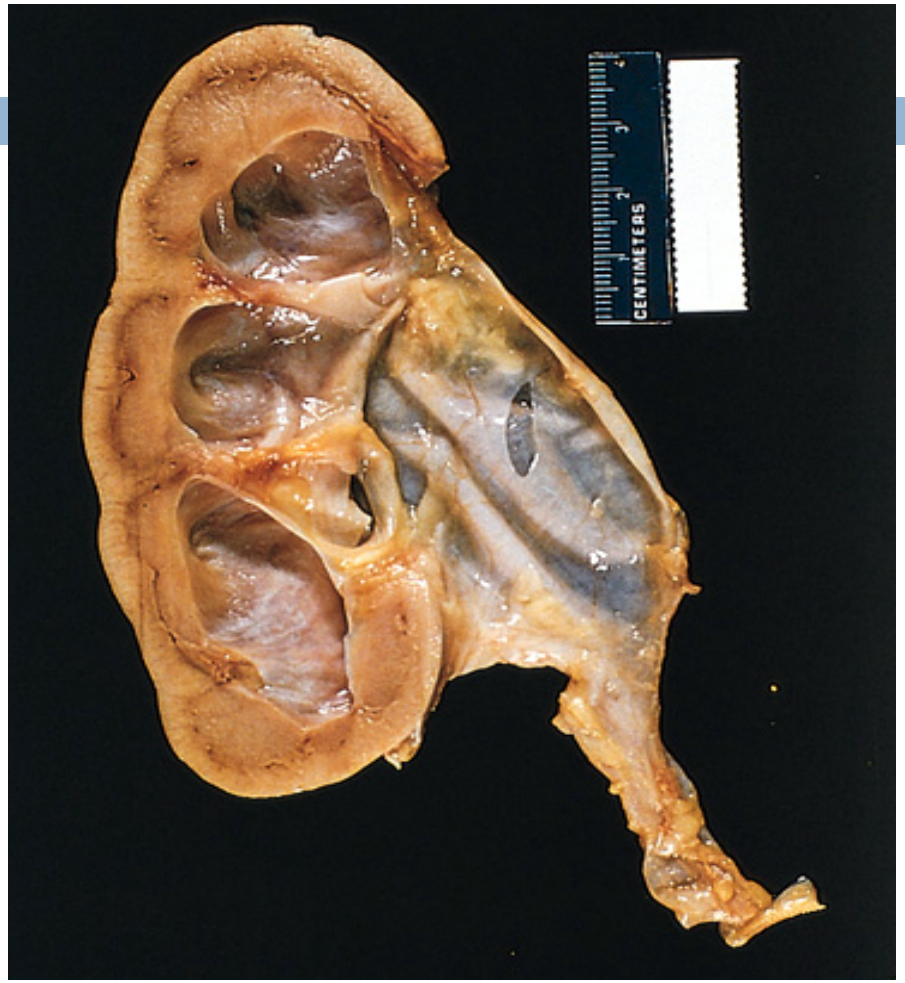
# Stone in renal pelvis (nephrolithiasis) → Staghorn calculi



- *Usually renal stones are unilateral and multiple.*
- *Stones vary in size from few mm to large stones that dilate the entire renal pelvis. They range from hard to soft , from smooth to rough.*
- *Staghorn calculi take the shape of the pelvicalyceal system. They are large stones are usually composed of magnesium ammonium phosphate.*
- *What are the predisposing factors of urolithiasis? What are the types of stones found in the kidney?*

# HYDRONEPHROSIS

# Hydronephrosis



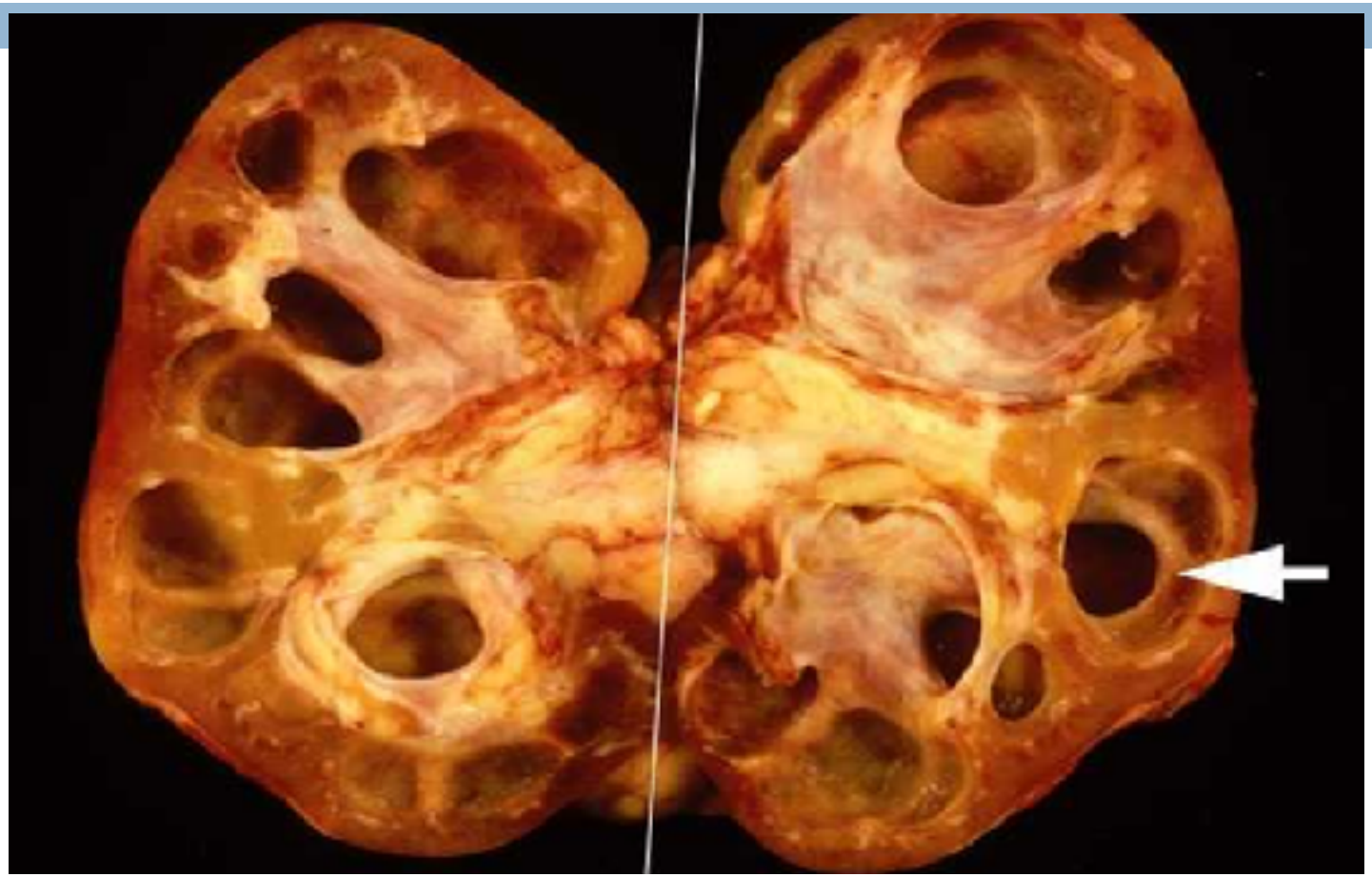

***The picture shows markedly dilated renal pelvis and calyces with atrophic and thin renal cortex /parenchyma***

***The most common causes are:***

- *Foreign bodies like calculi with obstruction,*
- *Atresia of the urethra,*
- *Benign prostatic hyperplasia ,*
- *Neoplasia of the prostate and bladder*
- *Spinal cord damage with paralysis of the bladder .*

***Cut section of kidney shows markedly dilated renal pelvis and calyces with atrophic and thin renal cortex /parenchyma***

# Hydronephrosis



*Markedly dilated renal pelvis and calyces with atrophic and thin renal cortex*

# THE END