PATHOLOGY OF THE RENAL SYSTEM

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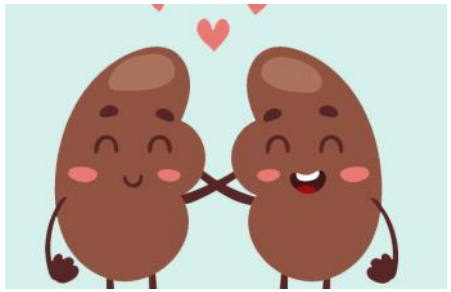
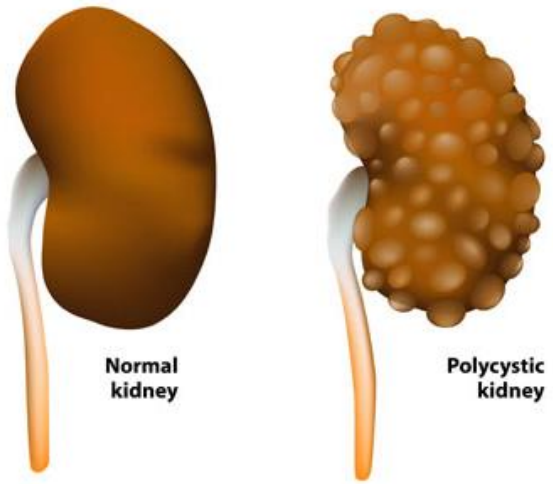


CYSTIC DISEASES OF THE KIDNEY



- Cystic diseases of the kidney are a heterogeneous group, which are important for several reasons: (1) Adult polycystic disease causes 10% of all CRF cases, (2) Cysts are common & often present diagnostic problems for clinicians, radiologists, & pathologists and ,rarely, they can be confused with malignant tumors.

- Types of cysts:

1-Simple Cysts
2-Dialysis-associated acquired cysts
3-Autosomal Dominant (Adult) Polycystic Kidney Disease
4-Autosomal Recessive (Childhood) Polycystic Kidney Disease
5-Medullary Cystic Disease

1. SIMPLE CYSTS

- Multiple or single
- 1-5 cm in diameter
- Translucent filled with clear fluid & lined by a gray, glistening, smooth membrane composed of a single layer of cuboidal or flattened epithelium.
- Confined to the cortex.
- No clinical significance.
- Usually discovered incidentally or because of hemorrhage and pain
- Importance to differentiate from kidney tumors

2. CYSTS ASSOCIATED WITH CHRONIC DIALYSIS

- Seen in patients with renal failure who have prolonged dialysis.
- In both cortex and medulla
- Complications: hematuria; pain
- Increased risk of renal carcinomas (100 times greater than in the general population)
- Occasionally, renal adenomas or even adenocarcinomas(RCC) arise in the walls of these cysts.

3. Autosomal Dominant (Adult) Polycystic Kidney Disease

- Multiple bilateral cysts
- Eventually destroy the renal parenchyma.
- Incidence (1: 500-1000) persons
- 10% of chronic renal failure.
- Pathogenesis: The disease can be caused by inheritance of one of at least two autosomal dominant genes of very high penetrance.
- In 85% to 90% of families, PKD1,the defective gene is on the short arm of chromosome 16. This gene encodes polycystin-1.
- In 10-15%, PKD2: encodes polycystin- 2.

❑Clinical presentation:

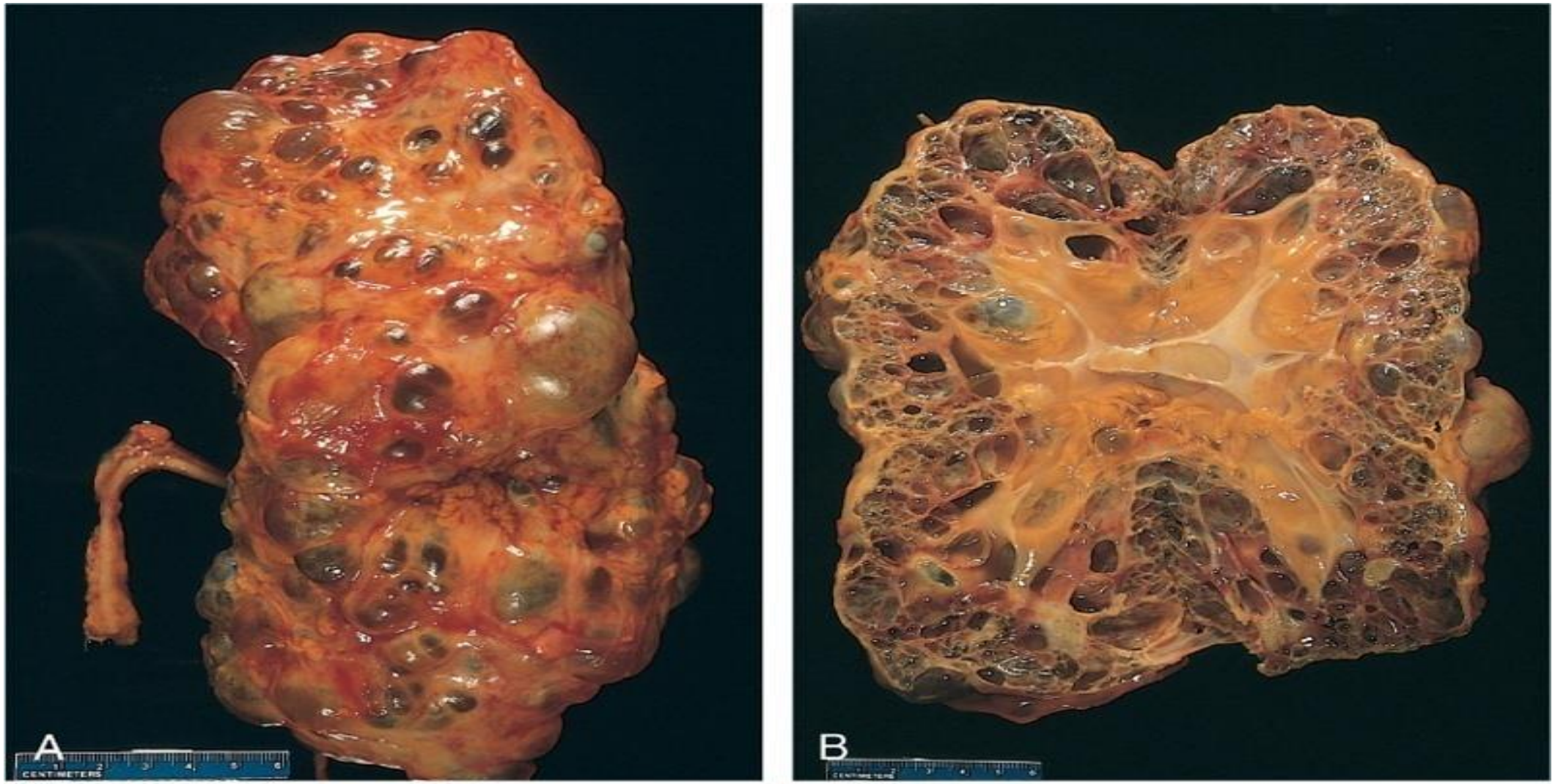
- Asymptomatic until the 4th decade.
- Symptoms: flank pain , heavy dragging sensation, abdominal mass, hemorrhage, obstruction, Intermittent gross hematuria
- Grossly:
- The kidneys may reach enormous size (weights of up to 4 kg for each kidney).
- These very large kidneys are readily palpable as abdominally masses.
- Both kidneys composed solely of cysts, up to 4 cm with no intervening parenchyma.
- The cysts are filled with fluid, which may be clear, turbid, or hemorrhagic.

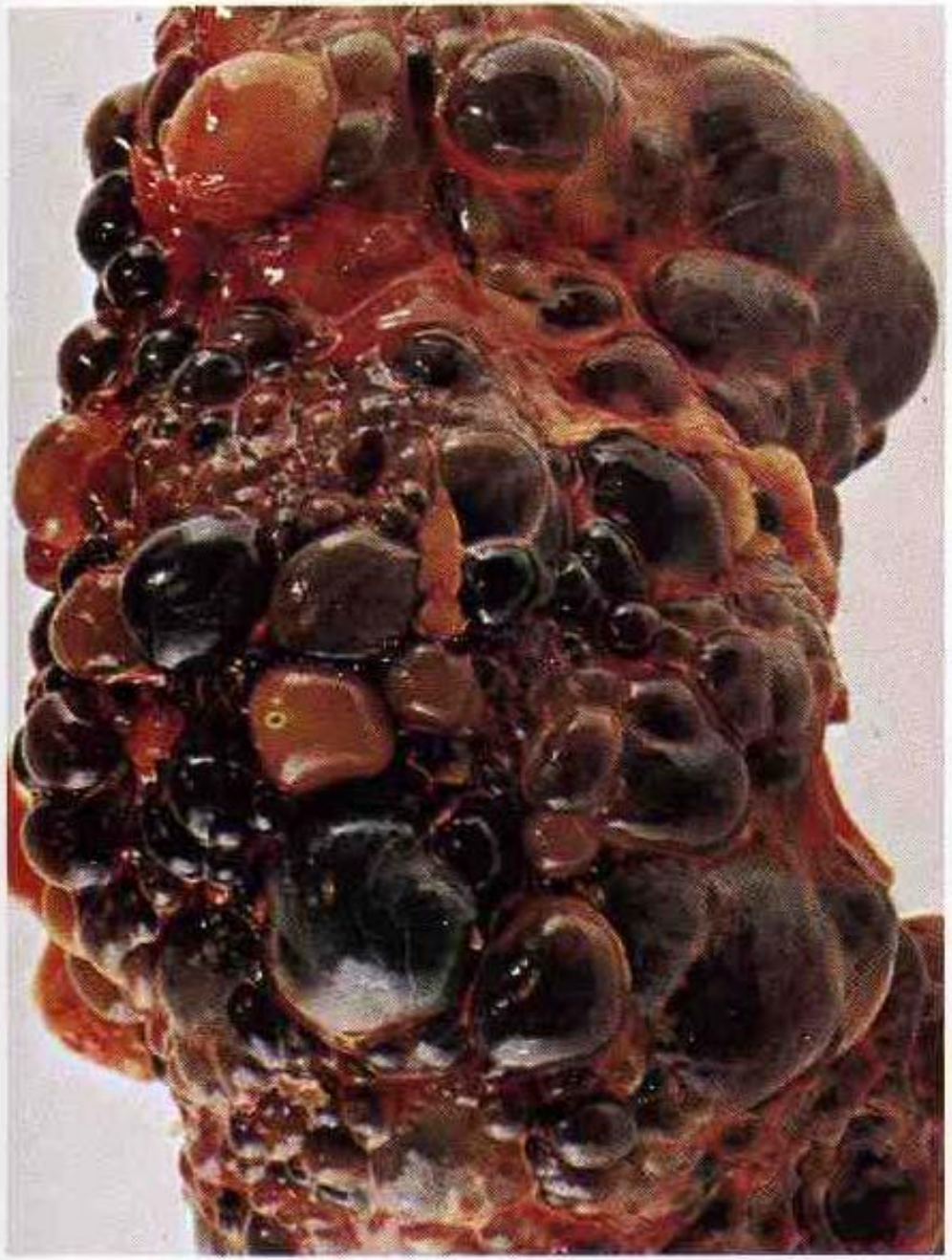
Complications:

1. **Uremia & hypertension** (which develops in 75% of cases)
2. **Urinary infection.**
3. **Saccular aneurysms** of the brain circle of Willis are present in 10% to 30% of patients, & these individuals have a high incidence of subarachnoid hemorrhage.

- Although the disease tends to progresses very slowly, but it is ultimately **fatal** from **uremia or hypertensive complications.**
- Treatment is by renal **transplantation**.

AUTOSOMAL DOMINANT (ADULT) POLYCYSTIC KIDNEY DISEASE

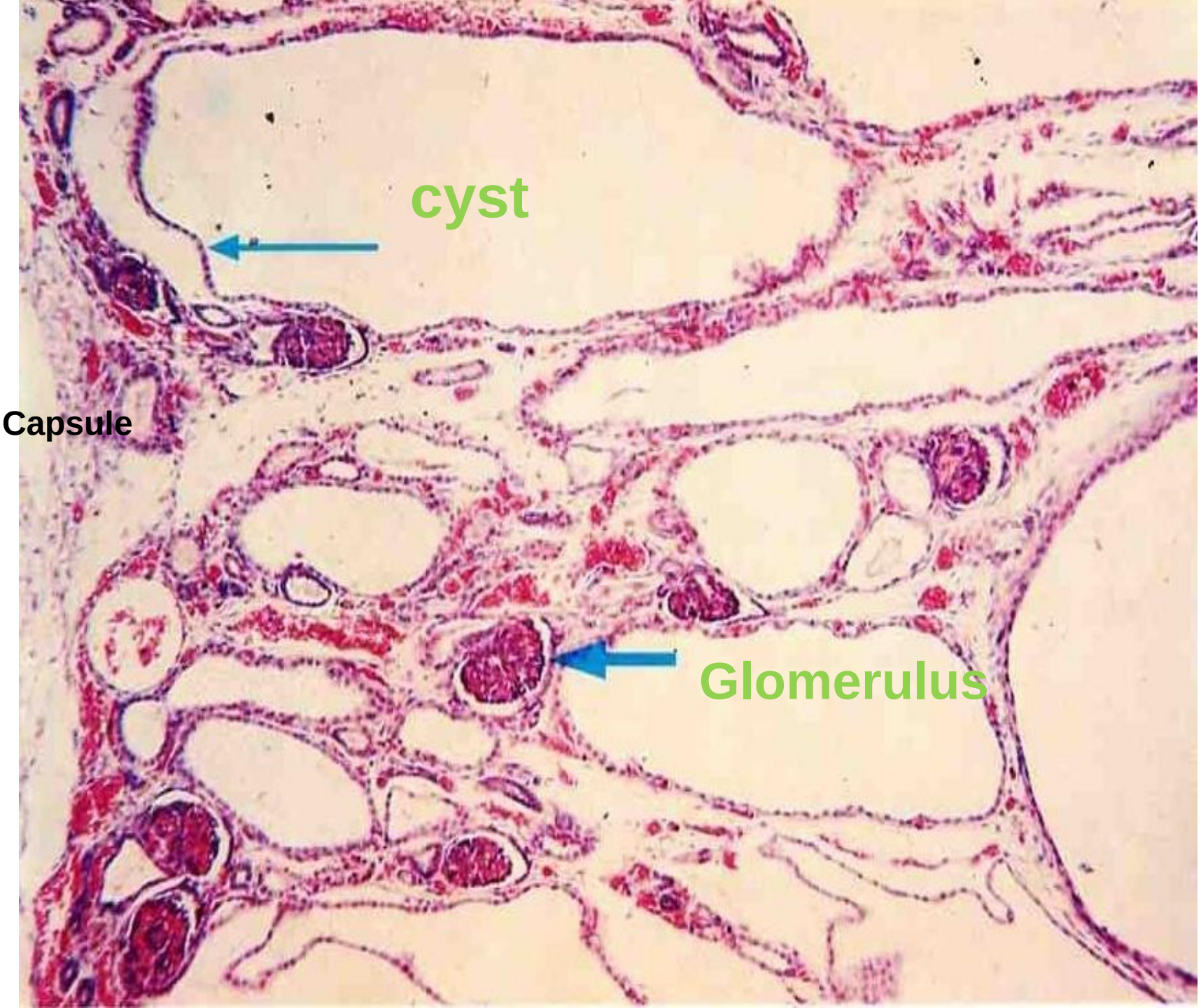




10.4 Polycystic kidneys (adult type)

Polycystic Kidneys (Adult type). Massively enlarged **4000 g** kidney,**(Normal 300g),** consists of numerous small & large cysts bulging through the capsule.

★Some cysts contain clear urine, others are bluish-black from old hemorrhage



Adult polycystic Kidney.

Cortex of the kidney, with the capsule on the left. **No normal tubules are present**, & instead, the kidney bulk consists of various size **cysts**, lined by flattened epithelium (**thin** arrow).

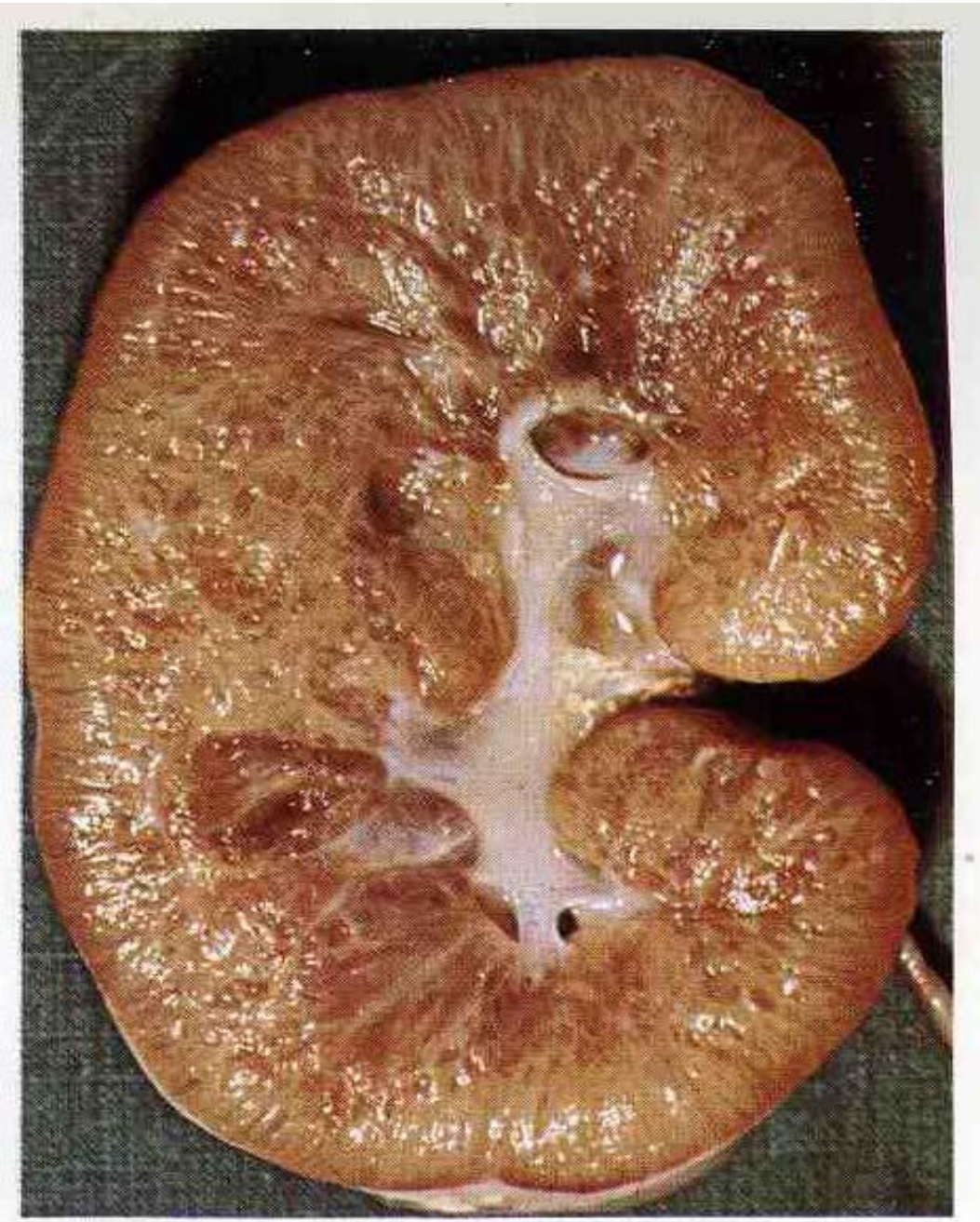
However, many normal looking **glomeruli (thick** arrow) remain between the cysts.

4. Autosomal Recessive (Childhood) Polycystic Kidney Disease

- Autosomal recessive
- Rare ,1:20,000 live births.
- Depending on time of presentation & the presence of associated hepatic lesions, there are: perinatal, neonatal, infantile, & juvenile subcategories have been defined.
- **All results** from mutations in a gene PKHD1,coding for a putative membrane receptor protein(fibrocystin)localized to chromosome 6p.
- Fibrocystin may be involved in the function of cilia in tubular epithelial cells .

❑Grossly:

- The disease is invariably bilateral, with numerous small cysts in the cortex & medulla give the kidneys as spongelike appearance.
- The medulla & cortex are completely replaced by dilated & elongated channels & cysts.
- These cysts originating from the collecting tubules & are lined by cuboidal cells.
- In all cases (100%), there are multiple cysts in the liver as well as proliferation of portal bile ducts.



10.3 Infantile polycystic kidneys

Autosomal Recessive (Childhood) Polycystic Kidney Disease.

★A bilateral renal defect which is **incompatible with life.**

★Sponge-like enlarged kidney from the presence of large number of small cysts, in the cortex & medulla which are abnormally, enlarged collecting tubules

5. Medullary Cystic Disease

- 2 major types:

1-medullary sponge kidney:

- Common and innocent(Harmless) condition.

2-nephronophthisis-medullary cystic disease complex:

- Almost always associated with renal dysfunction.
- Usually begins in childhood.

- Cysts are at cortico-medullary junction.
- In aggregate, the various forms of nephronophthisis are now thought to be the most common genetic cause of end-stage renal disease in children & young adults.

- Four variants of this disease complex are recognized on the basis of the time of onset: **infantile, juvenile, adolescent, & adult.**
- The juvenile form is the most common.
- 5% to 20% of individuals with juvenile nephronophthisis have extra-renal manifestations, which mostly appear as retinal abnormalities.
- Grossly:
- The kidneys are small & contracted.
- Numerous small cysts lined by flattened or cuboidal epithelium are present, typically at the cortico-medullary junction.

❑Clinical features:

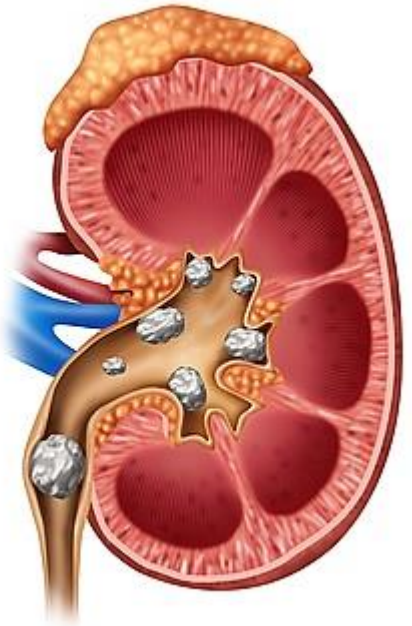
- Polyuria and polydipsia (↓tubular function).
- Renal failure over 5-10-year

❑ The disease is difficult to diagnose, because:

1. No serologic markers &
2. The cysts may be too small to be seen with radiologic imaging or
3. The cysts may not be apparent on renal biopsy if the cortico-medullary junction is not well sampled.

- A positive family history & unexplained CRF in young patients should lead to suspicion of nephronophthisis-medullary cystic disease complex.

UROLITHIASIS



❑Renal Stones (Urolithiasis)

- Stone formation at any level in the urinary collecting system.
- Most common in kidney.
- (1%) of all autopsies.
- Symptomatic more common in men .
- Familial tendency toward stone formation.
- Unilateral in 80%.
- •Variable sizes.
- Stone = inorganic salt (98%) + organic matrix (2%)

❖Types are according to inorganic salt:

1. Calcium oxalate/calcium oxalate+ calcium phosphate-- (80%)
2. Struvite (magnesium ammonium phosphate)
3. Uric acid (6-7%)
4. Cystine stones (2%)

▪Causes of Renal Stones:

1- Increased urine concentration of stone's constituents exceeds solubility in urine (supersaturation).

- 50% of calcium stones pts have hypercalciuria with no hypercalcemia.
- 5% to 10% hypercalcemia and hypercalciuria due to hyperparathyroidism, vitamin D intoxication, or sarcoidosis.

2- The presence of a nidus

- Urates provide a nidus for calcium deposition.
- Desquamated epithelial cells
- Bacterial colonies

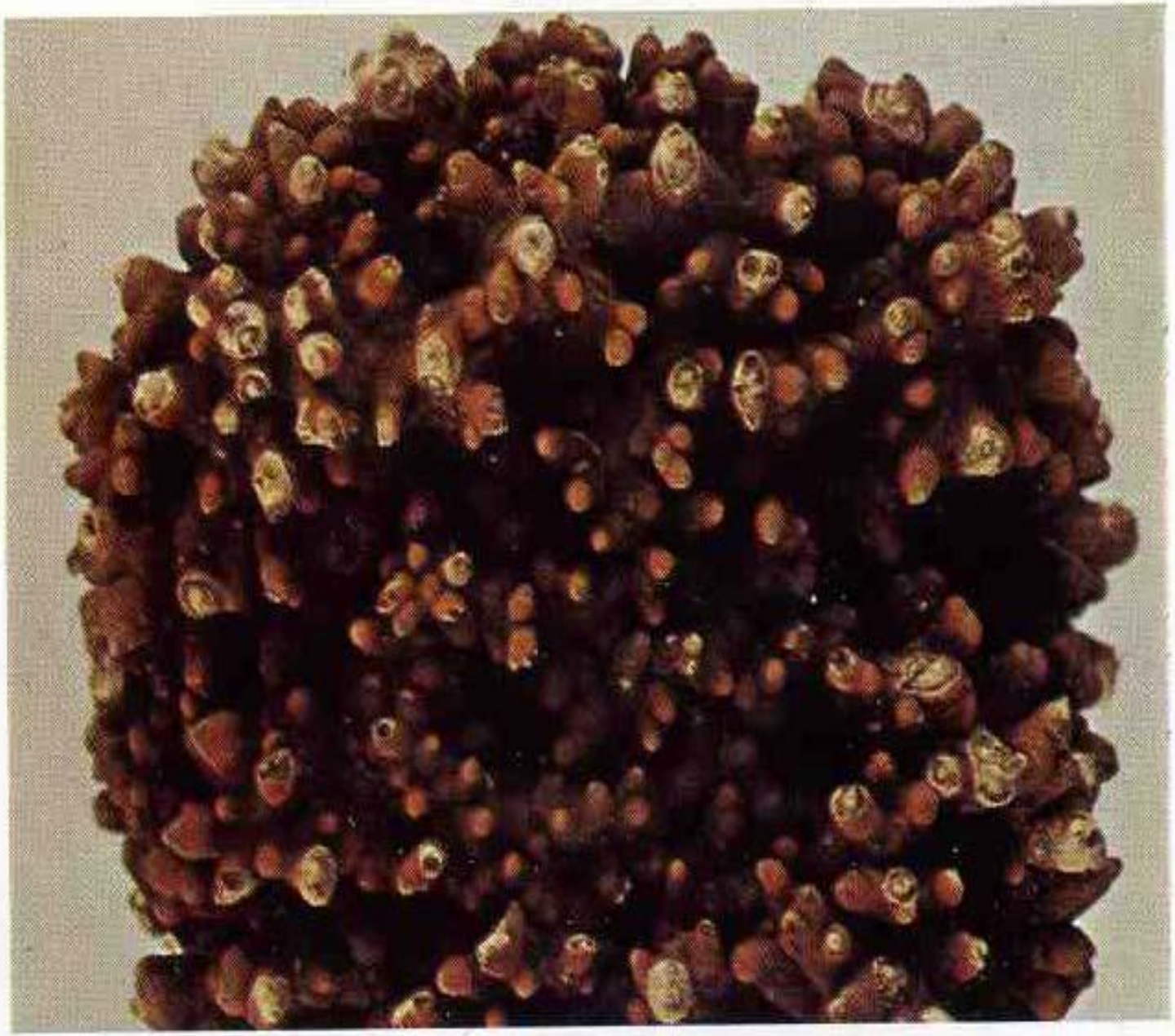
3- Urine pH

4- Infection

- **Magnesium ammonium phosphate (struvite) stones:**

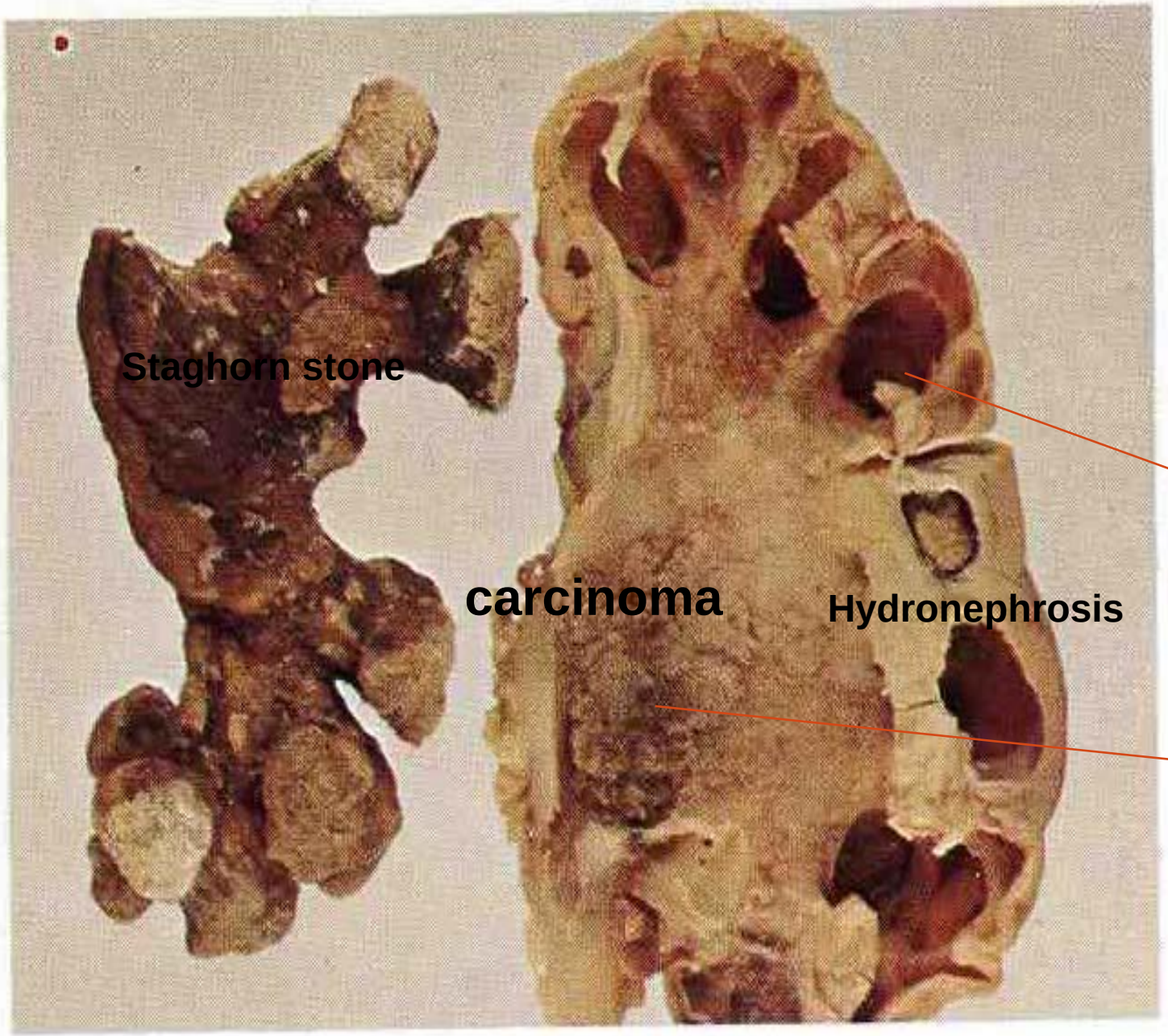
Staghorn shaped stones (almost always occur in persons with persistently alkaline urine due to UTIs, specially, due to urea-splitting bacteria, such as Proteus vulgaris& the staphylococci.

- **Uric acid stones form in acidic urine (under pH 5.5):**
- Gout& diseases involving rapid cell turnover, such as the leukemias, lead to high uric acid levels in the urine & the possibility of uric acid stones.
- However, 50% of the individuals with uric acid stones have neither hyperuricemia nor urine urate but, an unexplained persistent excretion of acidic urine.
- **Cystine stones:**
- Are almost invariably associated with a genetically determined defect in the renal transport of cystine amino acid.



10.10 Oxalate calculus

Oxalate calculus.
Large, hard, spherical stone with rough **spiny** surface



10.12 Phosphate calculus

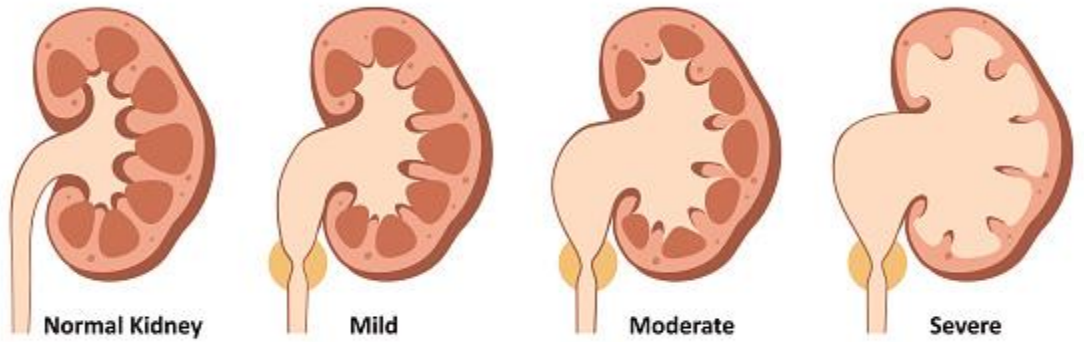
Staghorn stone (MgNH3PO4):
(I) **struvite stone** removed from the kidney where it formed a cast of the dilated pelvis & calyces.

The kidney shows:

(II) **hydronephrosis,** extensive destruction & extreme atrophy of the renal parenchymawith calculus debris present within some calyces.

(III) **sessile papillary tumor** in the pelvis **(adenocarcinoma)**following glandular metaplasia secondary to chronic stone irritation.

HYDRONEPHROSIS



HYDRONEPHROSIS

- Is dilation of the renal pelvis and calyces due to obstruction, with accompanying atrophy of kidney parenchyma.
- Sudden or insidious
- Obstruction at any level from the urethra to the renal pelvis.

❑ **The most common causes are:**

1- Congenital:

- Atresia of urethra
- Valve formations in ureter or urethra
- Aberrant renal artery compressing ureter
- Renal ptosis with torsion or kinking of ureter

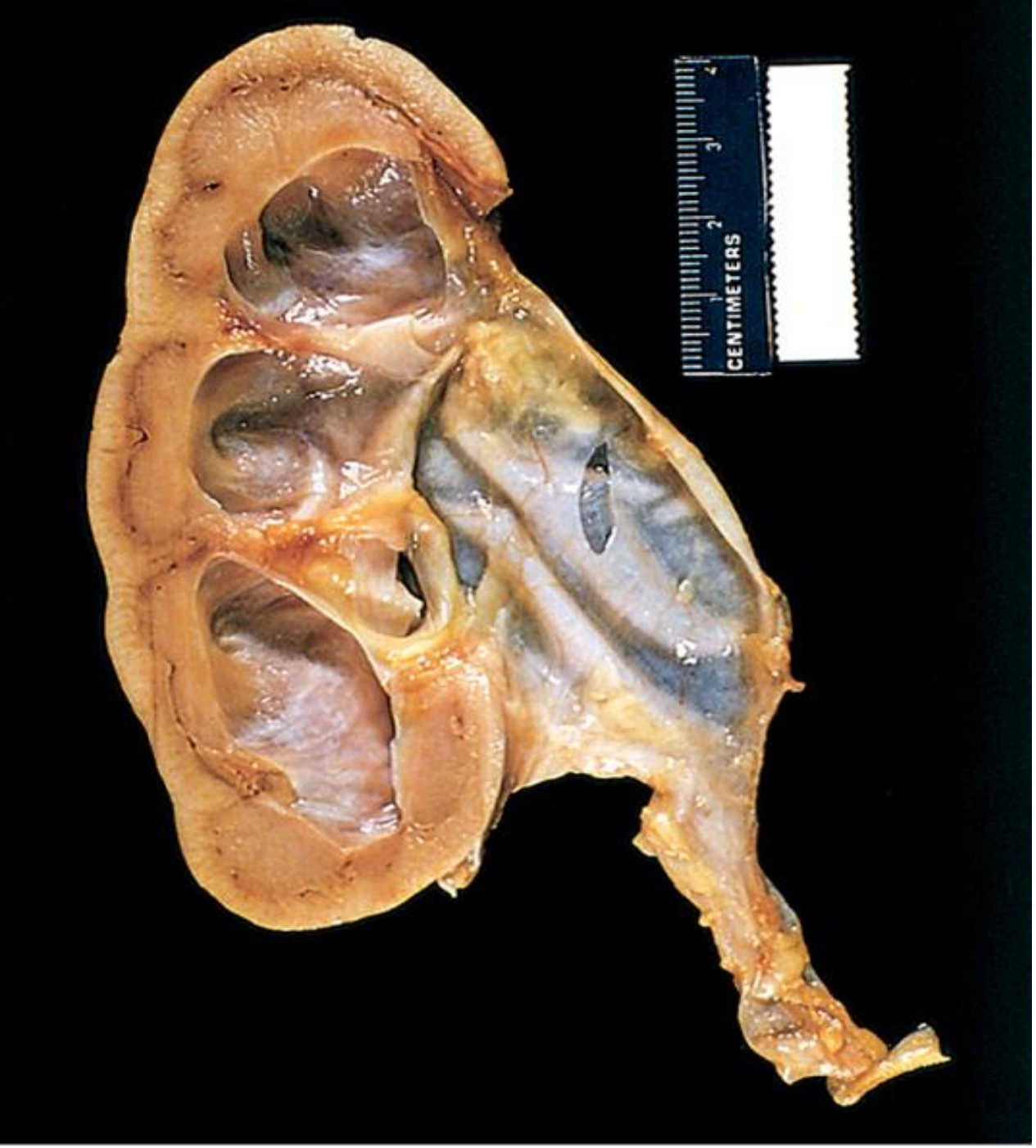
2- Acquired:

- Foreign bodies
- Calculi
- Necrotic papillae
- Tumors: prostatic hyperplasia, prostate cancer, bladder tumors, cervix or uterus cancer.
- Inflammation: Prostatitis, ureteritis, urethritis
- Neurogenic: Spinal cord damage
- Normal pregnancy: rare, mild and reversible

- If blockage is at the ureters or above, the lesion is **unilateral**.
- **Bilateral HN** occurs only when the obstruction is below the level of the ureters.

Pathogenesis:

- Even with complete obstruction, GF persists for some time & the filtrate subsequently diffuses back into the renal interstitium & prerenal spaces. Because of the continued filtration, the affected calyces & pelvis become dilated.
- The unusually high pressure thus generated in the renal pelvis, as well as that transmitted back through the collecting ducts, causes compression of the renal vasculature, with both venous stasis & arterial insufficiency.
- The most severe effects are seen in the papillae, because they are subjected to the greatest increase in pressure.
- Accordingly, the initial functional disturbances are largely tubular, manifested primarily by impaired concentration and later the G filtration begins to diminish.

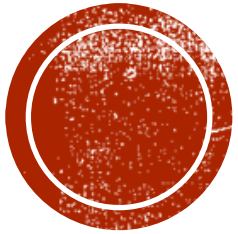


Hydronephrosis of the kidney:

★Marked dilation of the pelvis & calyces

&

★Thinning of the renal parenchyma



THANK YOU ☺