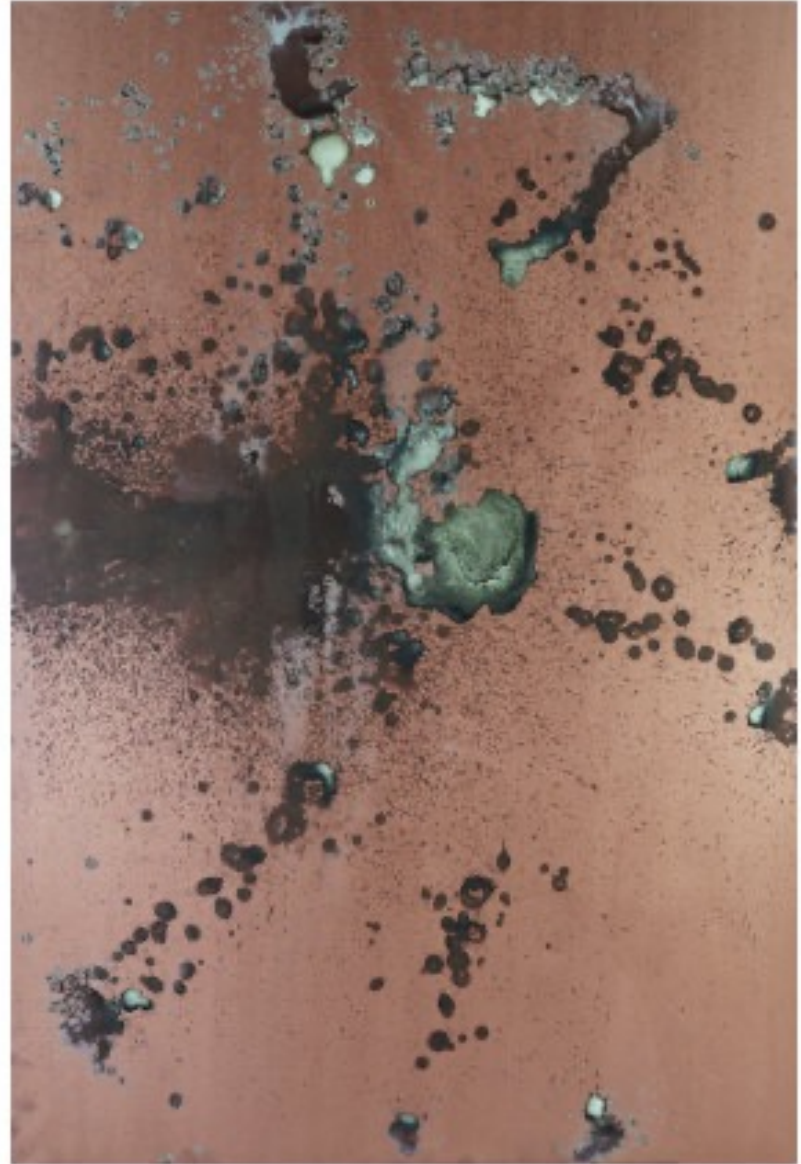


Renal Pathology

Kristine Krafts, M.D.



Renal Pathology Learning Objectives

- Define azotemia and uremia.
- Describe how acute and chronic renal failure present.
- List the four components of nephritic and nephrotic syndromes. What's the underlying cause of each? List the main diseases that cause each syndrome.
- For each of the glomerular diseases, make sure you understand the concepts on the “things you must know” slides.
- What is pyelonephritis, how does it present, and what causes it?

Renal Pathology Learning Objectives

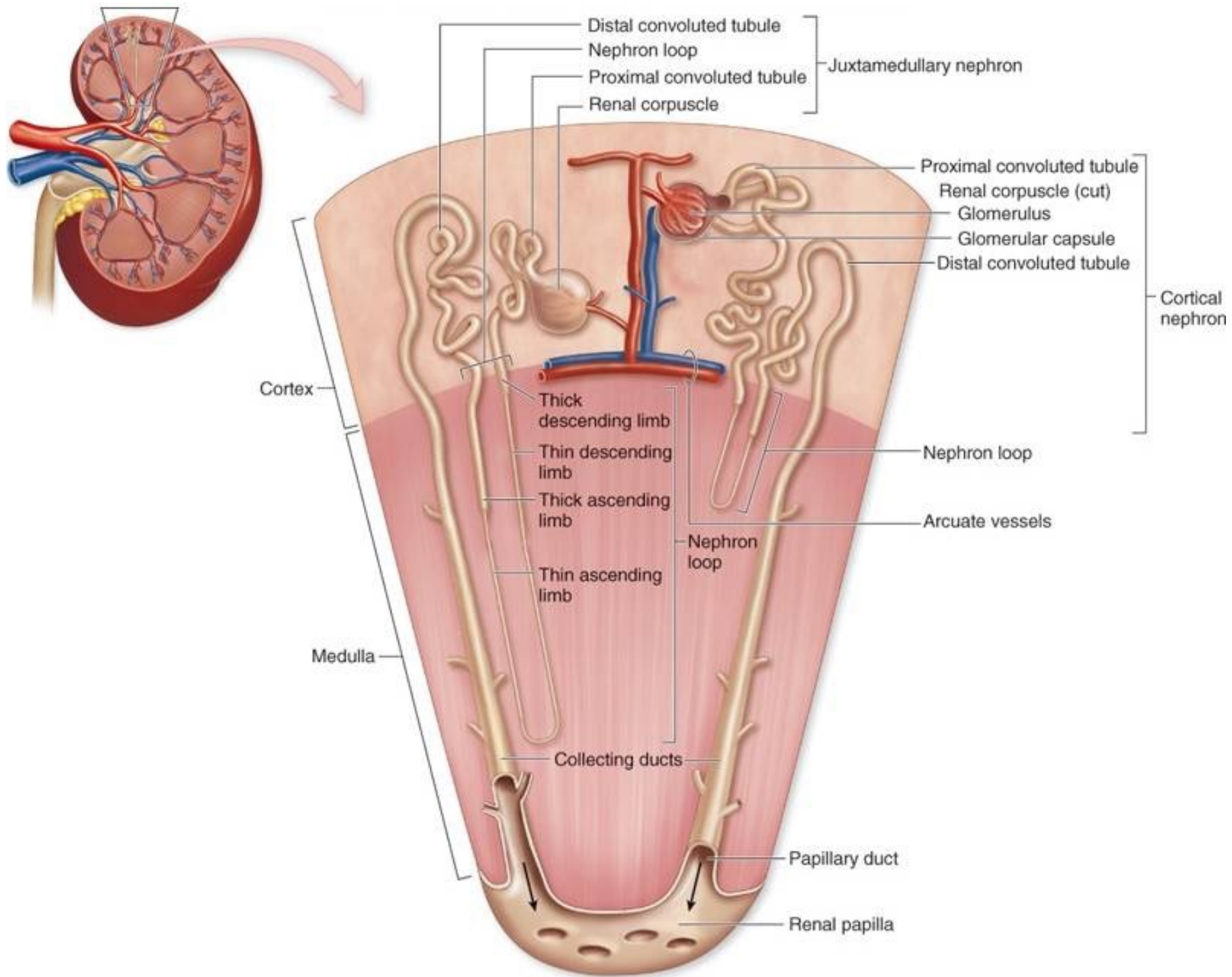
- What are the usual symptoms of urinary tract infection? Describe who gets complicated vs. uncomplicated UTIs, and know the most common organism causing each.
- For acute tubular necrosis, benign nephrosclerosis, and malignant nephrosclerosis, refer to the “things you must know” slides.
- Compare and contrast the inheritance pattern, morphologic appearance, and general prognosis of adult vs. childhood polycystic kidney disease.
- For renal cell and bladder carcinoma, refer to the “things you must know” slides.

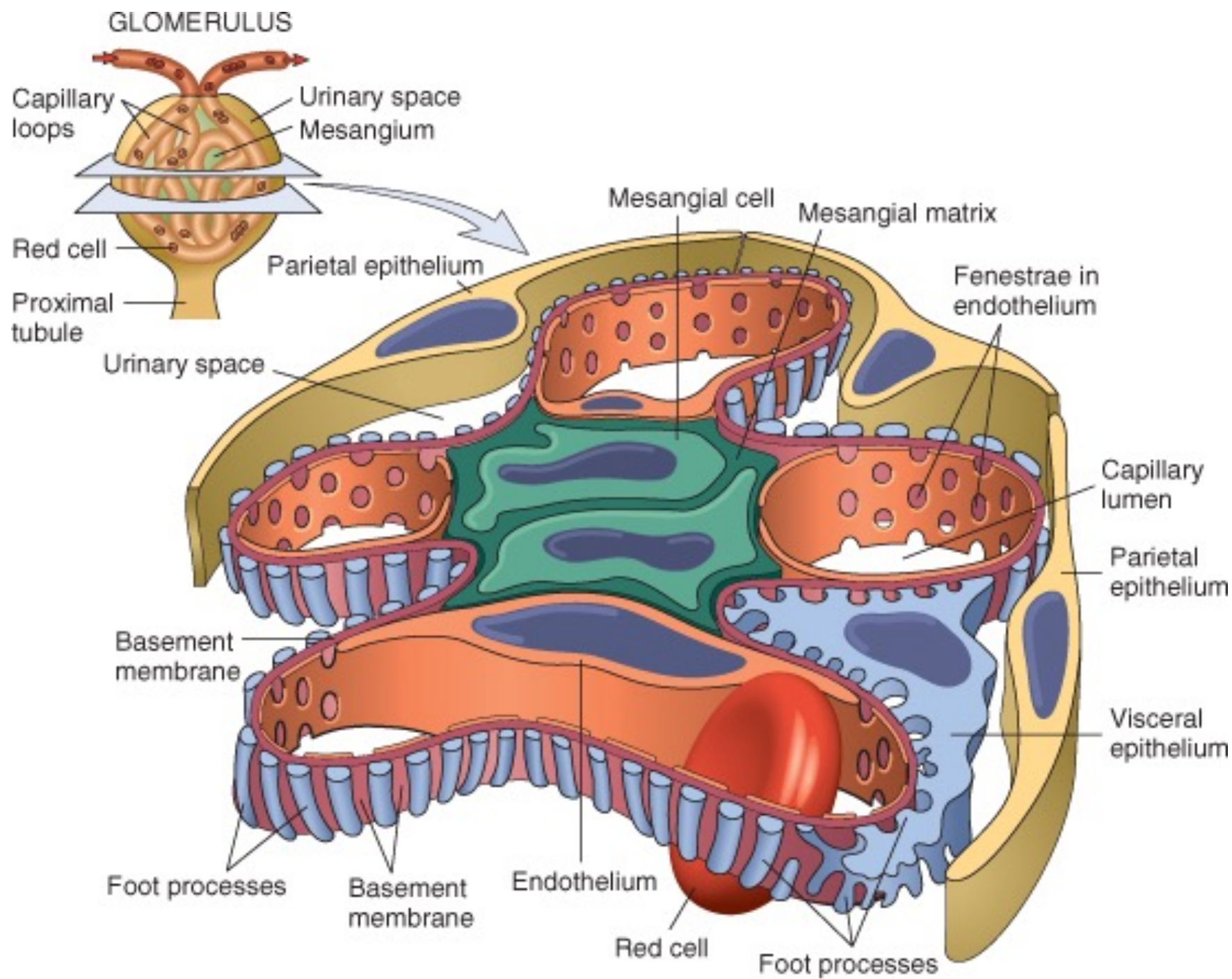
Renal Pathology Outline

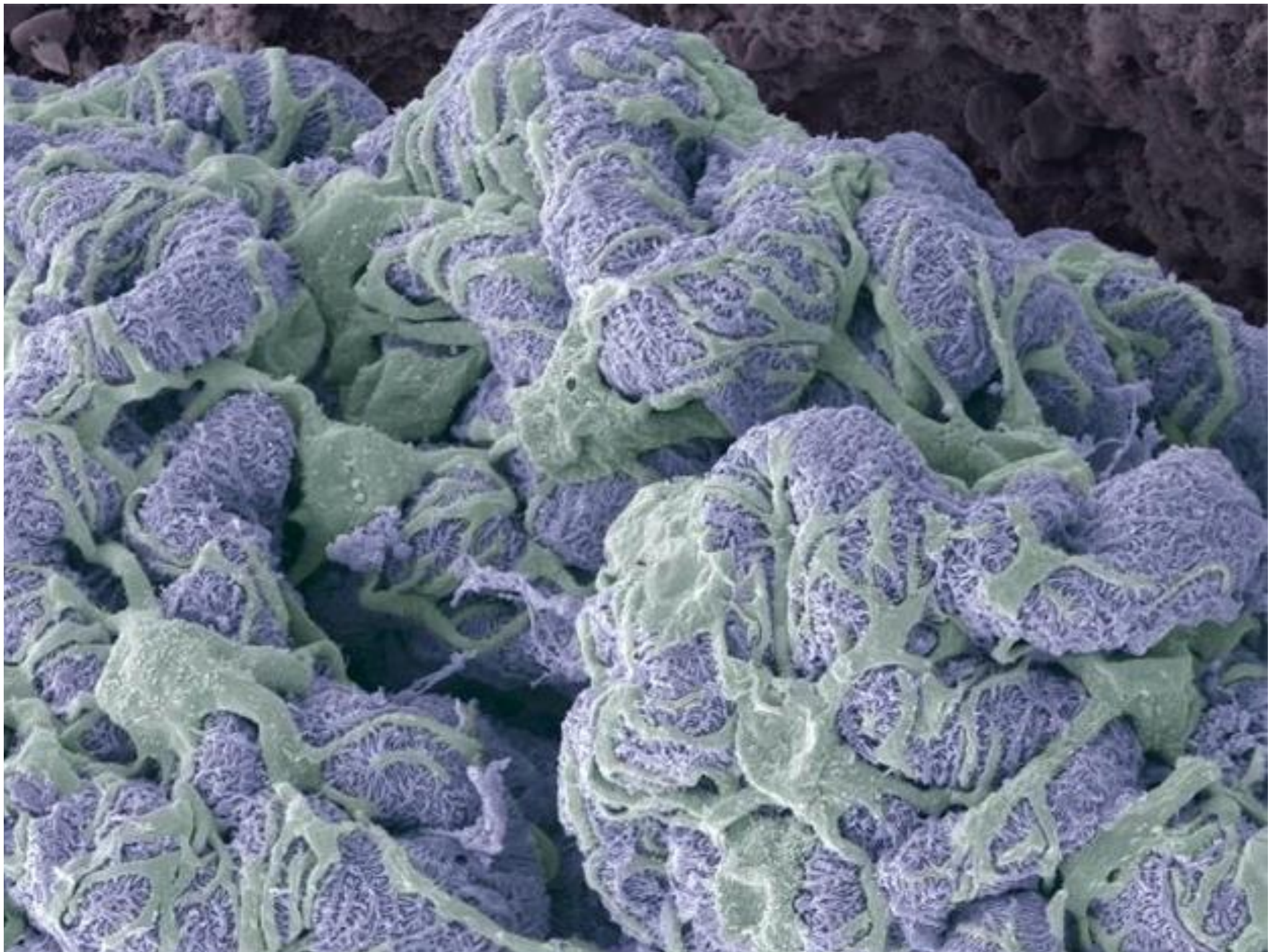
- Introductory stuff
- Glomerular diseases
- Tubular and interstitial diseases
- Diseases involving blood vessels
- Cystic diseases
- Tumors

Renal Pathology Outline

- Introductory stuff







Introductory Stuff

- Azotemia: ↑ BUN, creatinine
- Uremia: azotemia + more problems
- Acute renal failure: oliguria
- Chronic renal failure: prolonged uremia

Renal Pathology Outline

- Introductory stuff
- Glomerular diseases

Renal Pathology Outline

- Introductory stuff
- Glomerular diseases
 - Nephrotic syndrome
 - Minimal change disease
 - Membranous nephropathy
 - Nephritic syndrome
 - Postinfectious GN
 - IgA nephropathy

Nephro^Otic syndrome

pro^Oteinuria



- Massive proteinuria
- Hypoalbuminemia
- Edema
- Hyperlipidemia/-uria

Nephroⁱtic syndrome

inflamedⁱ glomerulus



- Hematuria
- Oliguria
- Azotemia
- Hypertension

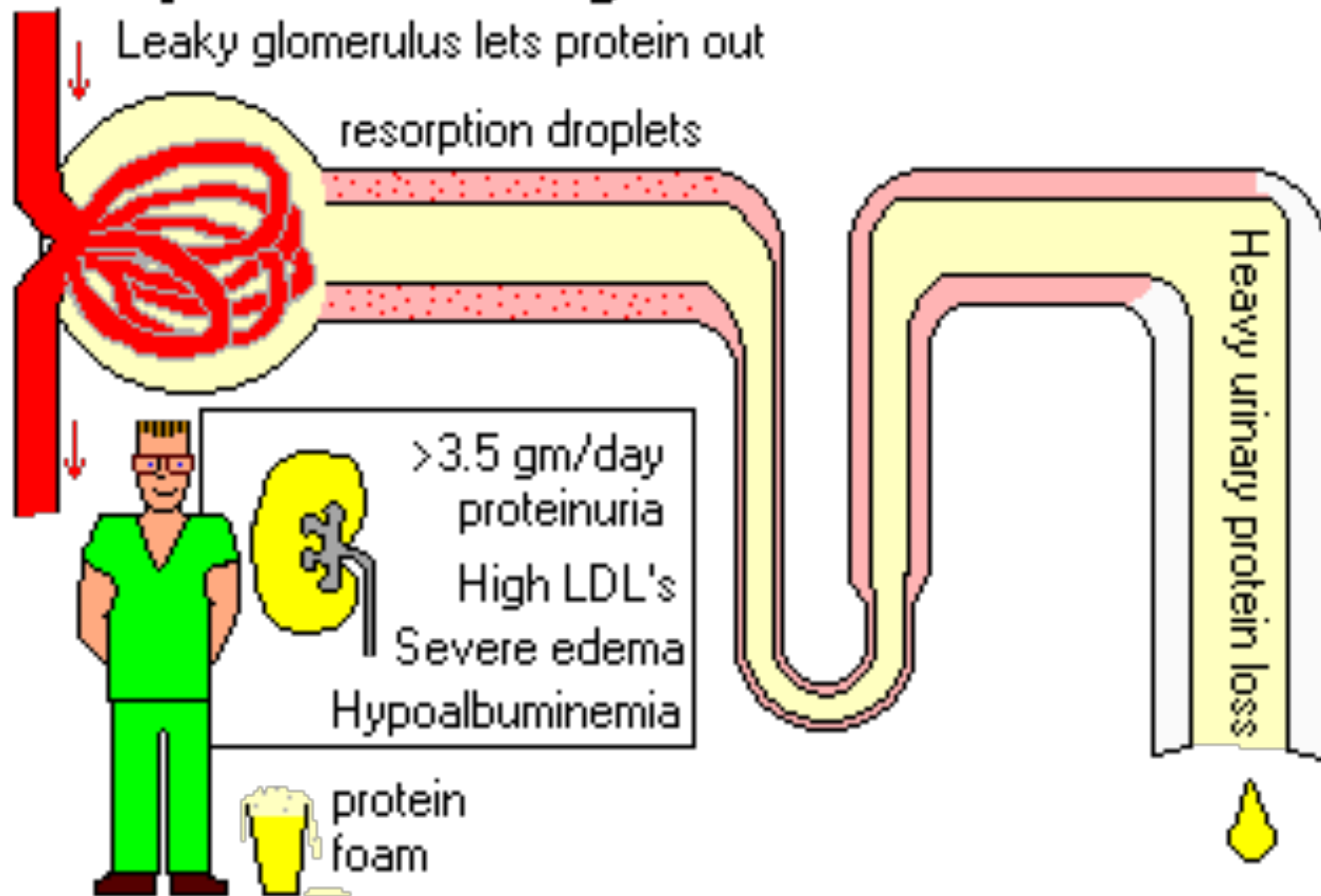
Nephrotic syndrome

- Massive proteinuria
- Hypoalbuminemia
- Edema
- Hyperlipidemia/-uria

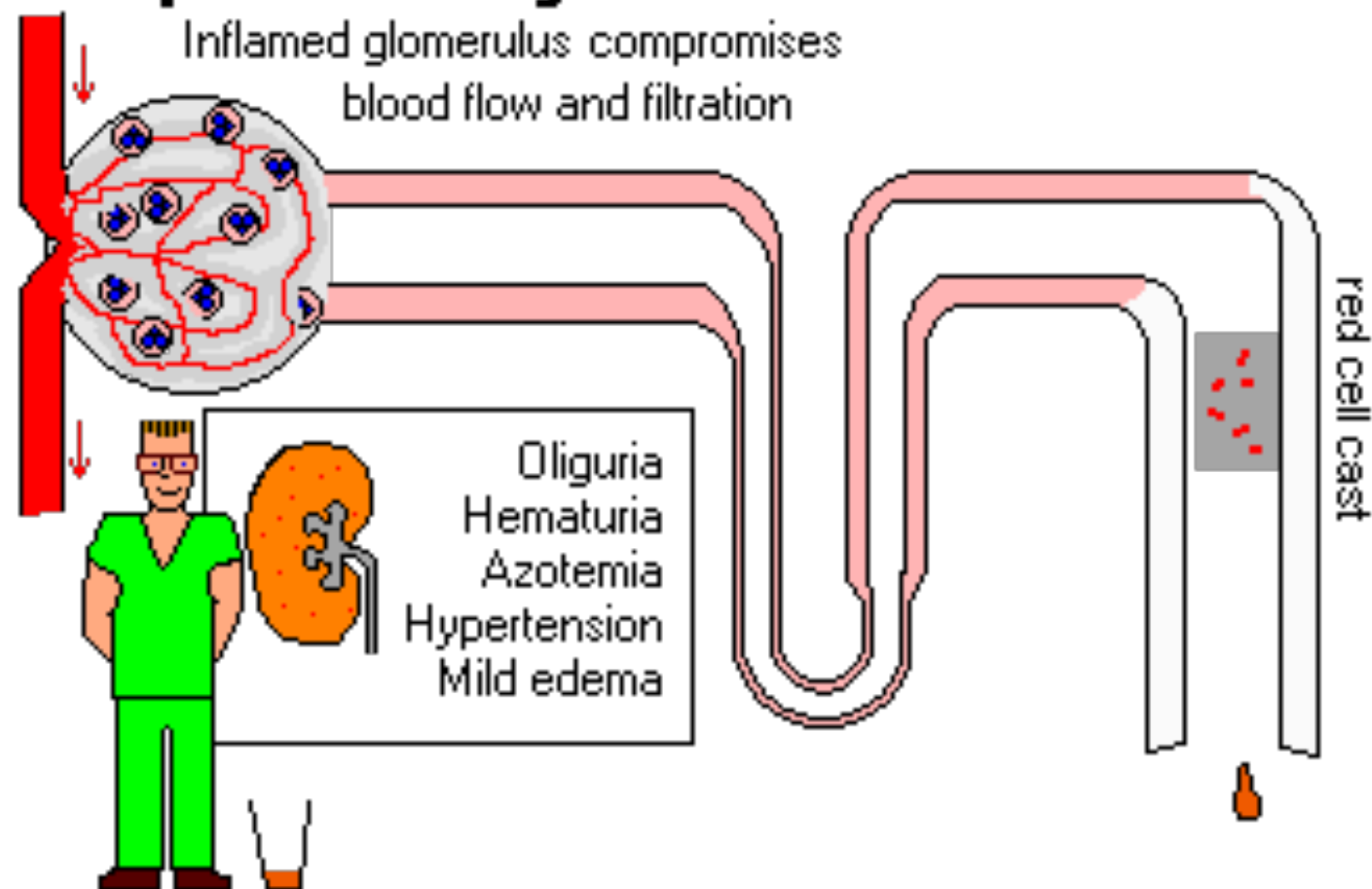
Nephritic syndrome

- Hematuria
- Oliguria
- Azotemia
- Hypertension

Nephrotic Syndrome



Nephritic syndrome



Renal Pathology Outline

- Introductory stuff
- Glomerular diseases
 - Nephrotic syndrome

Symptoms of Nephrotic Syndrome

- Massive proteinuria
- Hypoalbuminemia
- Edema
- Hyperlipidemia, lipiduria

Causes of Nephrotic Syndrome

- Adults: systemic disease (diabetes)
- Children: minimal change disease
- Characterized by loss of foot processes

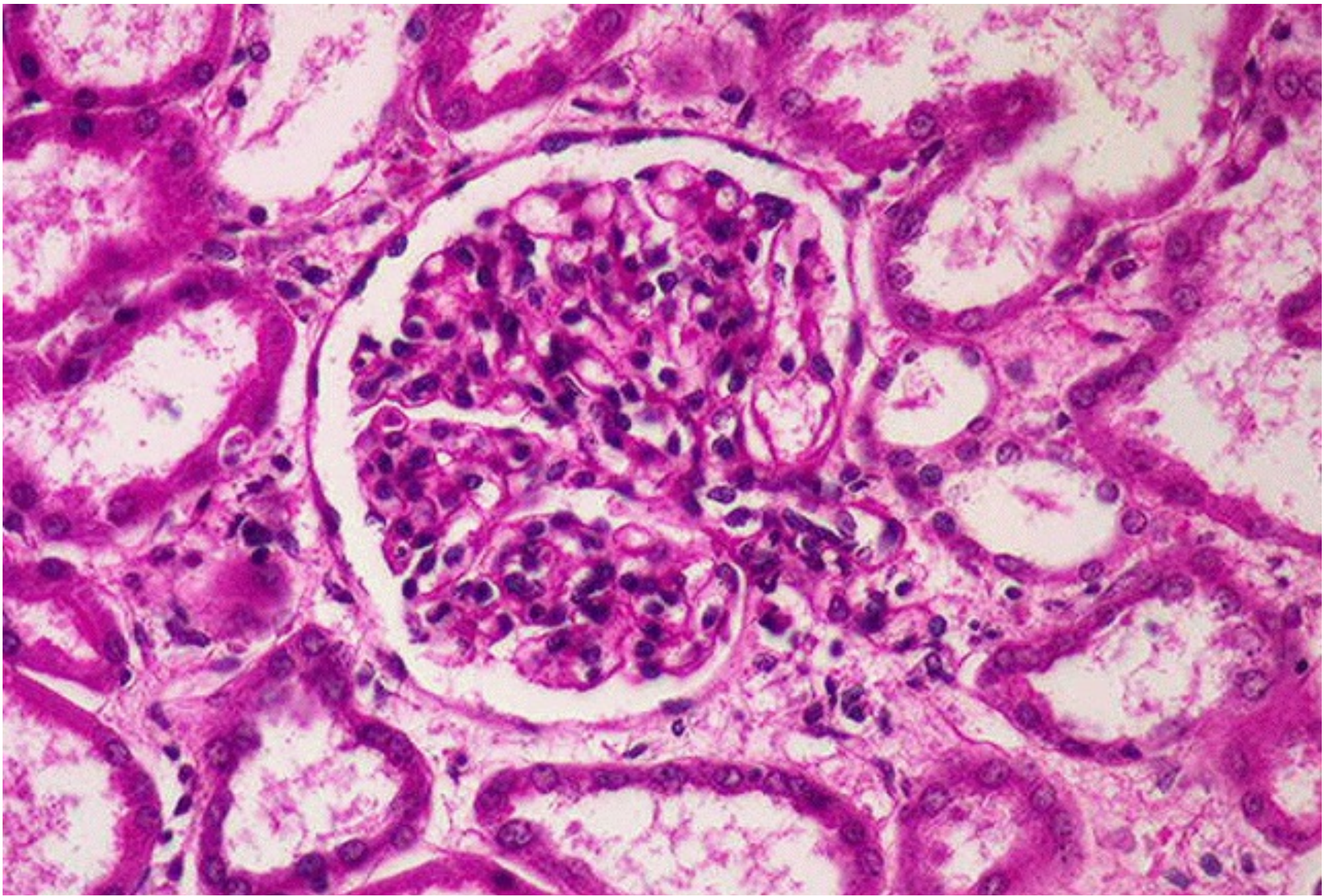
Renal Pathology Outline

- Introductory stuff
- Glomerular diseases
 - Nephrotic syndrome
 - Minimal change disease

Minimal Change Disease

Things You Must Know

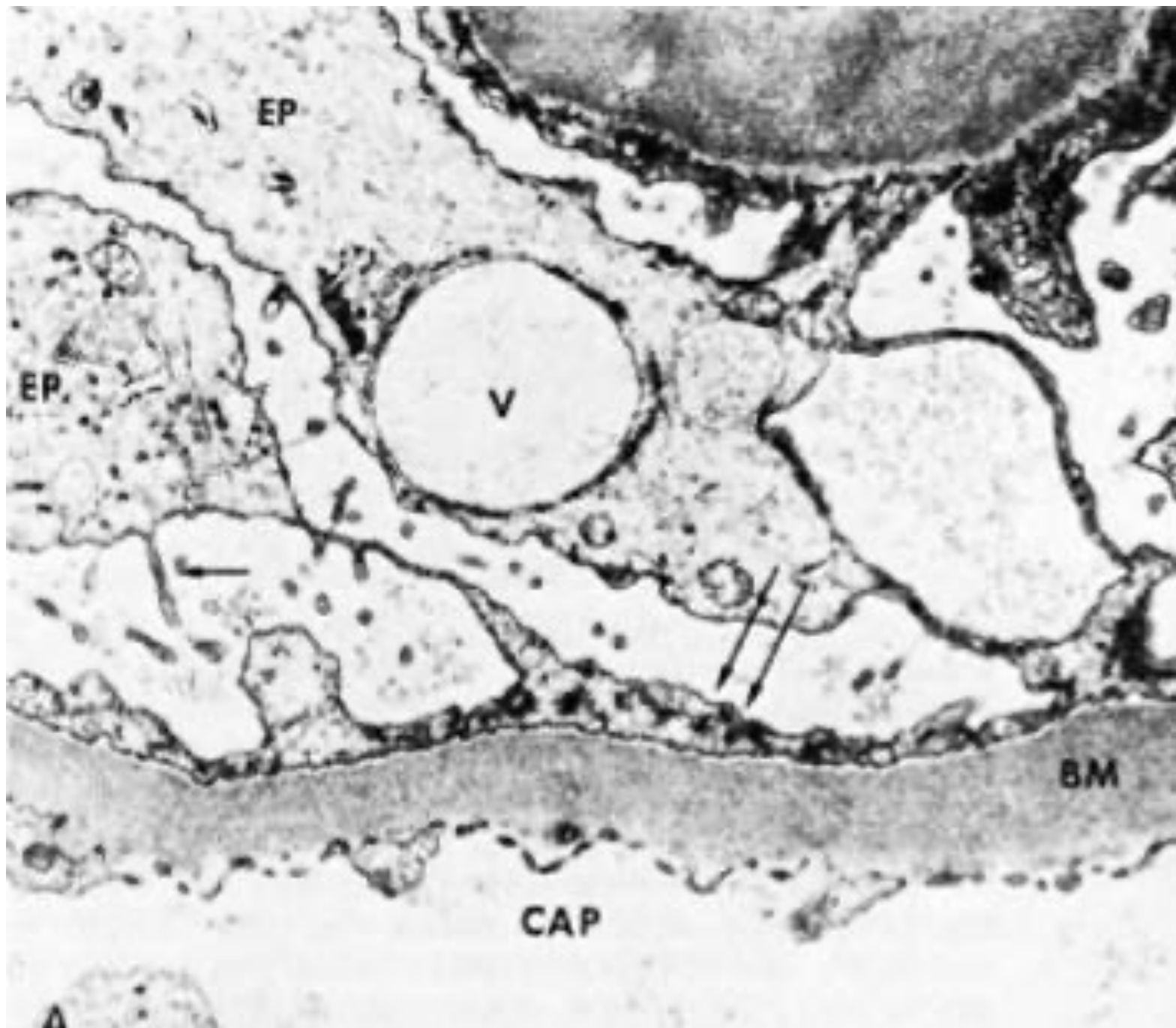
- #1 cause of nephrotic syndrome in children
- Loss of foot processes
- Pathogenesis unknown
- Good prognosis



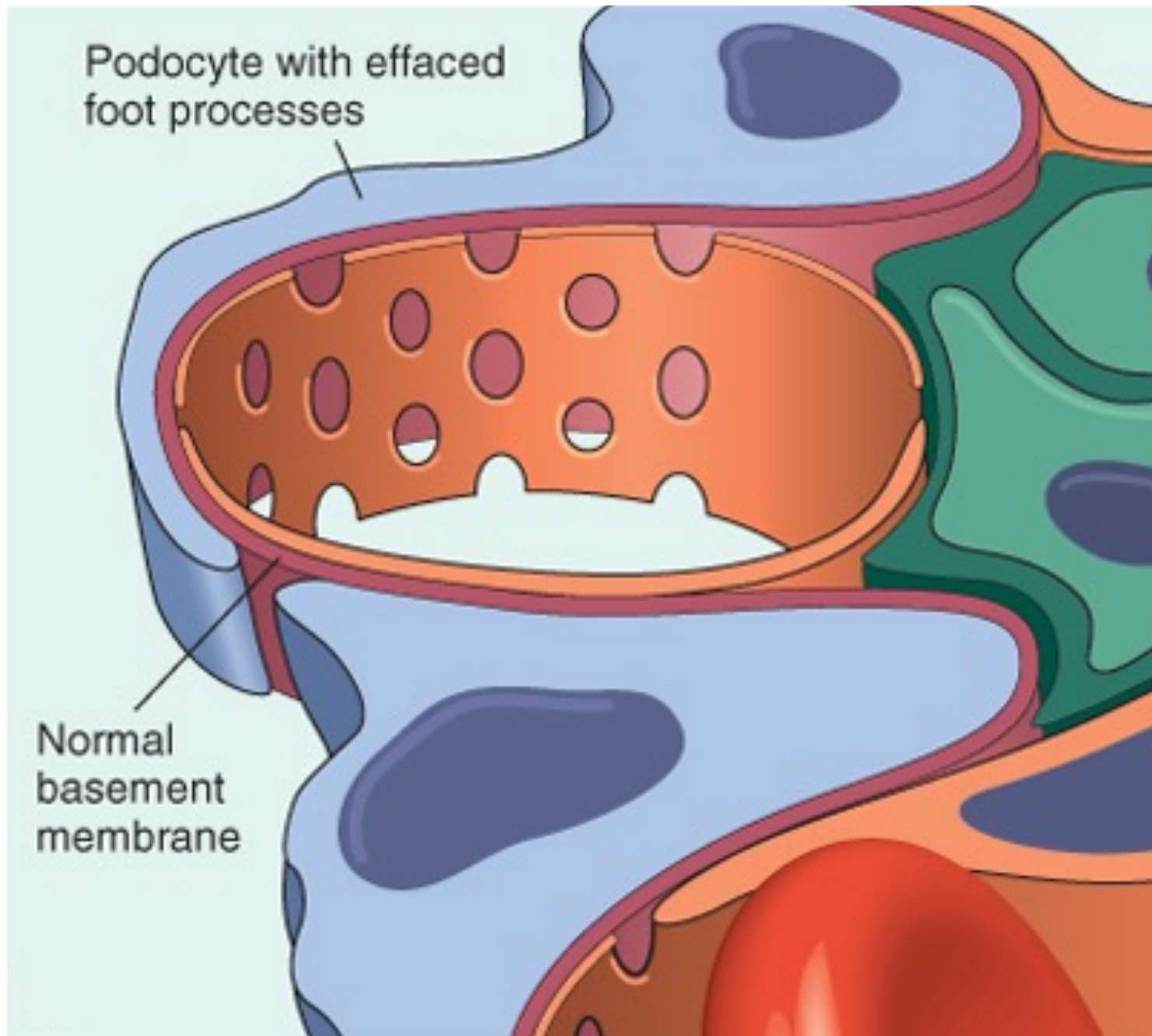
Minimal change disease



Normal glomerulus



Minimal change disease



Minimal change disease

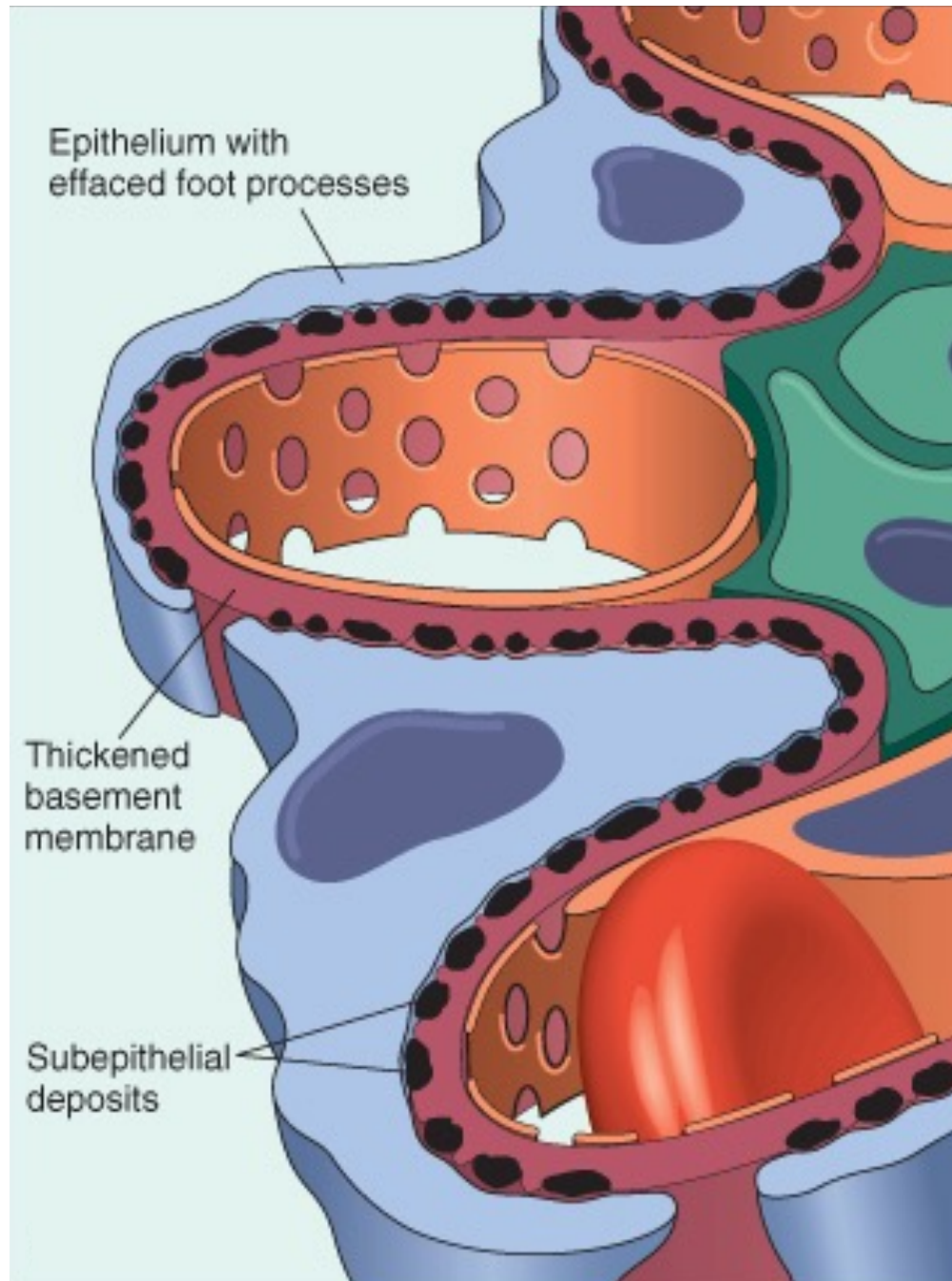
Renal Pathology Outline

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 - Nephrotic syndrome
 - Minimal change disease
 - Membranous nephropathy

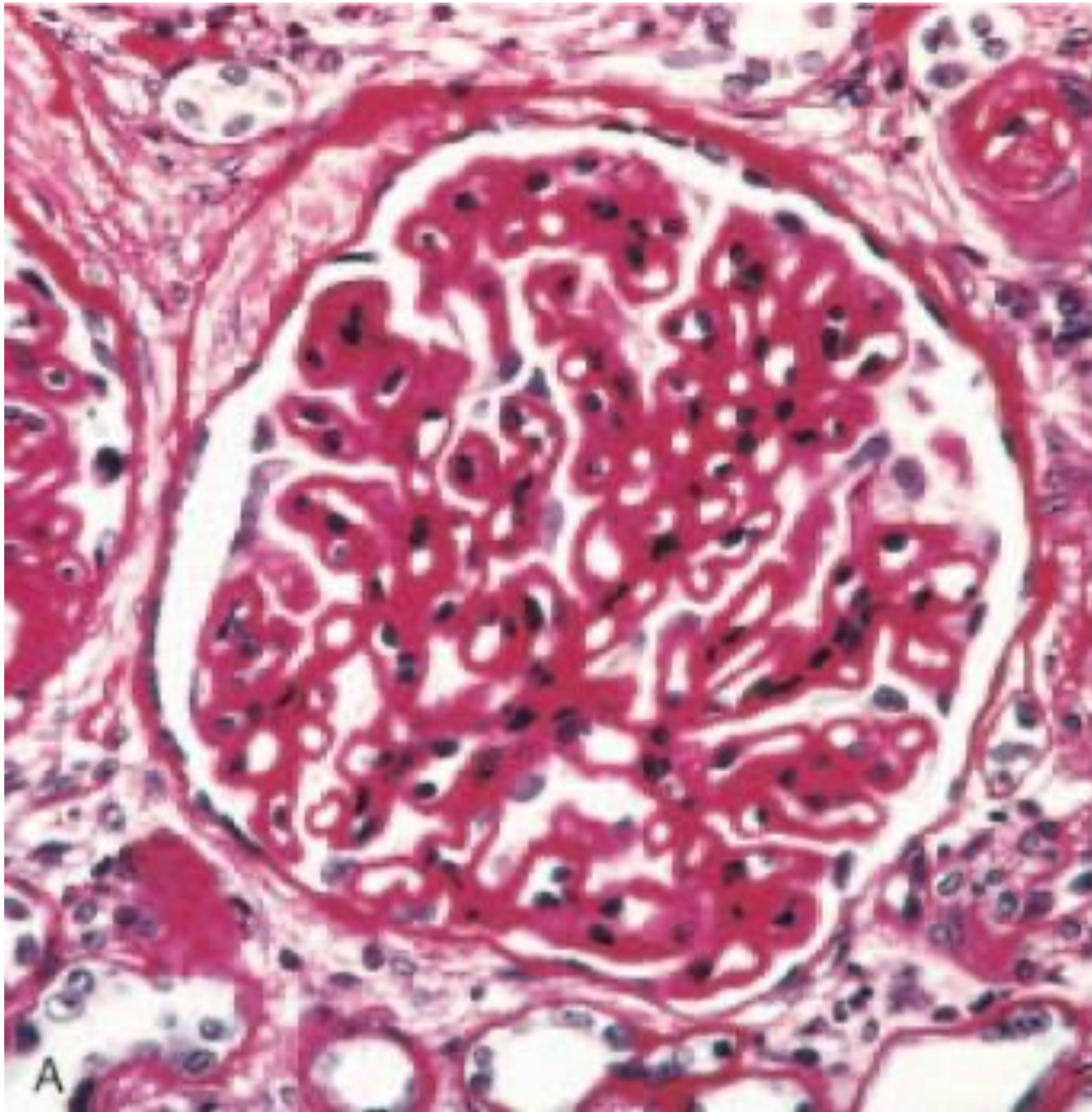
Membranous Nephropathy

Things You Must Know

- Autoimmune reaction against unknown renal antigen
- Immune complexes
- Thickened GBM
- Subepithelial deposits/spikes



Membranous nephropathy



Membranous nephropathy

Renal Pathology Outline

- Introductory stuff
- Glomerular diseases
 - Nephrotic syndrome
 - Minimal change disease
 - Membranous nephropathy
 - Nephritic syndrome

Symptoms of Nephritic Syndrome

- Hematuria
- Oliguria, azotemia
- Hypertension

Causes of Nephritic Syndrome

- Post-infectious GN, IgA nephropathy
- Immunologically-mediated
- Characterized by proliferative changes and inflammation

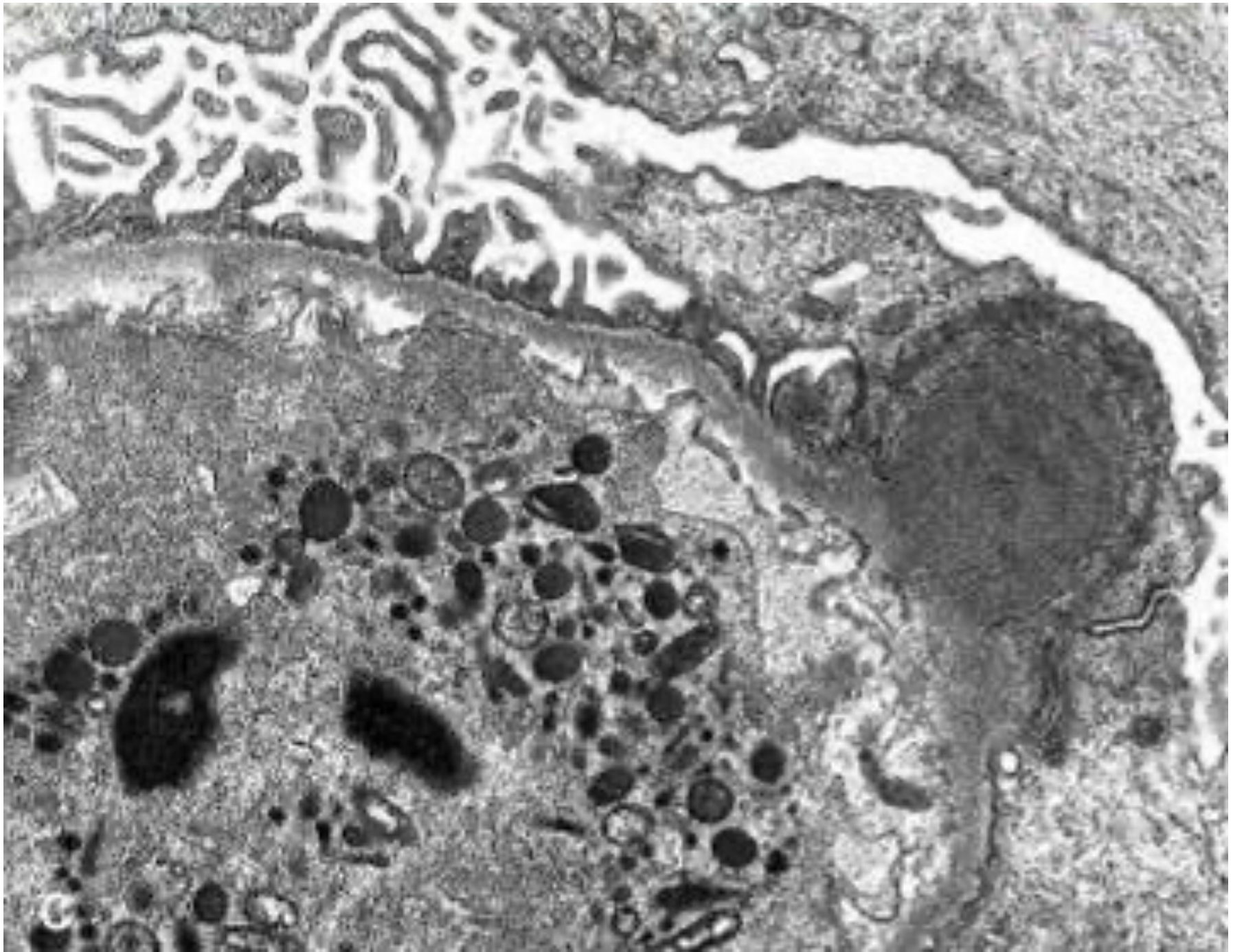
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 - Nephritic syndrome
 - Postinfectious GN

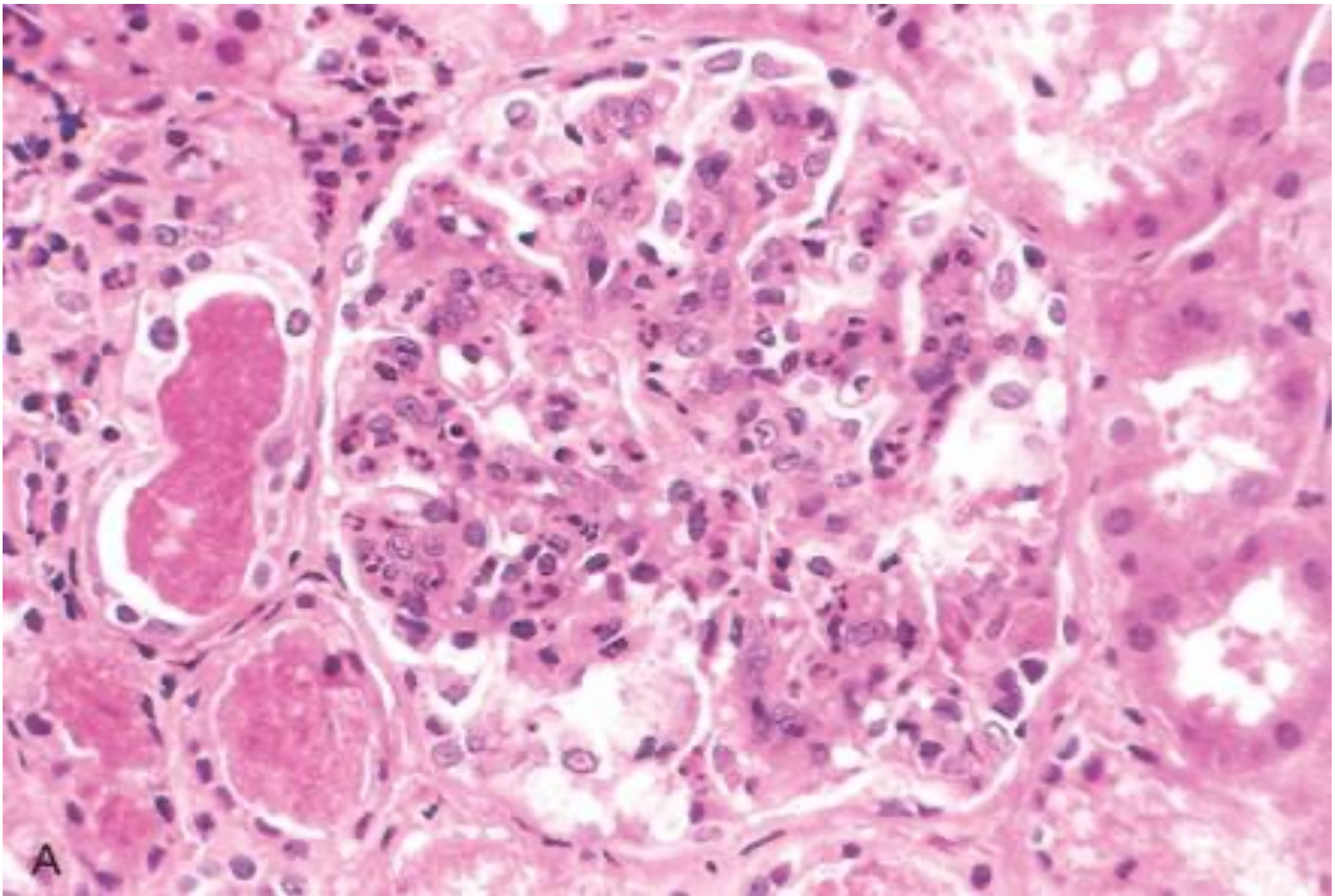
Post-Infectious Glomerulonephritis

Things You Must Know

- Child after strep throat
- Immune complexes
- Hypercellular glomeruli
- Subepithelial humps



Post-infectious glomerulonephritis



Post-infectious glomerulonephritis

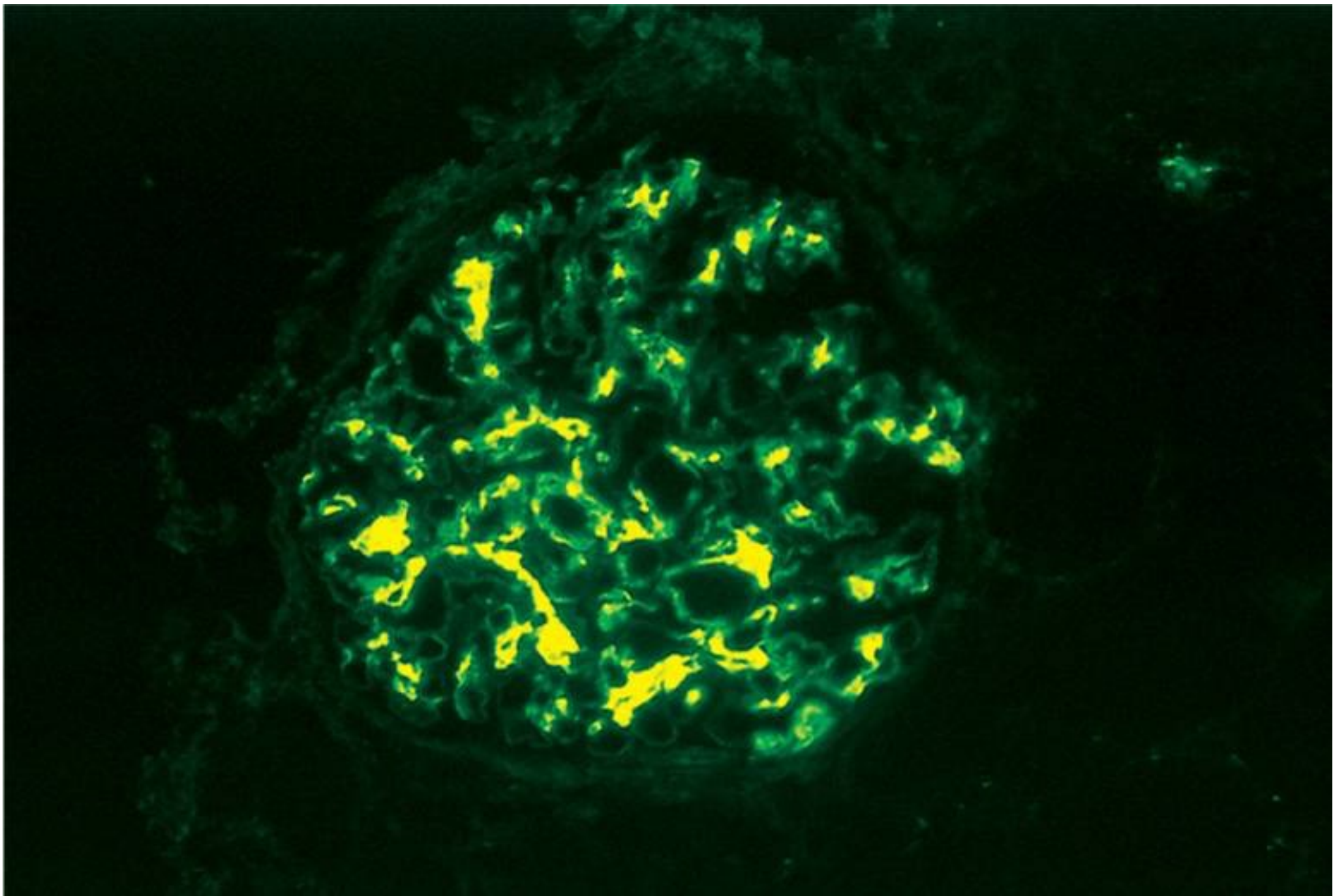
Renal Pathology Outline

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 - Nephritic syndrome
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 - IgA nephropathy

IgA Nephropathy

Things You Must Know

- Common!
- Child with hematuria after URI
- IgA in mesangium
- Variable prognosis



IgA nephropathy

Renal Pathology Outline

- Introductory stuff
- Glomerular diseases
- Tubular and interstitial diseases
 - Pyelonephritis
 - Acute tubular necrosis

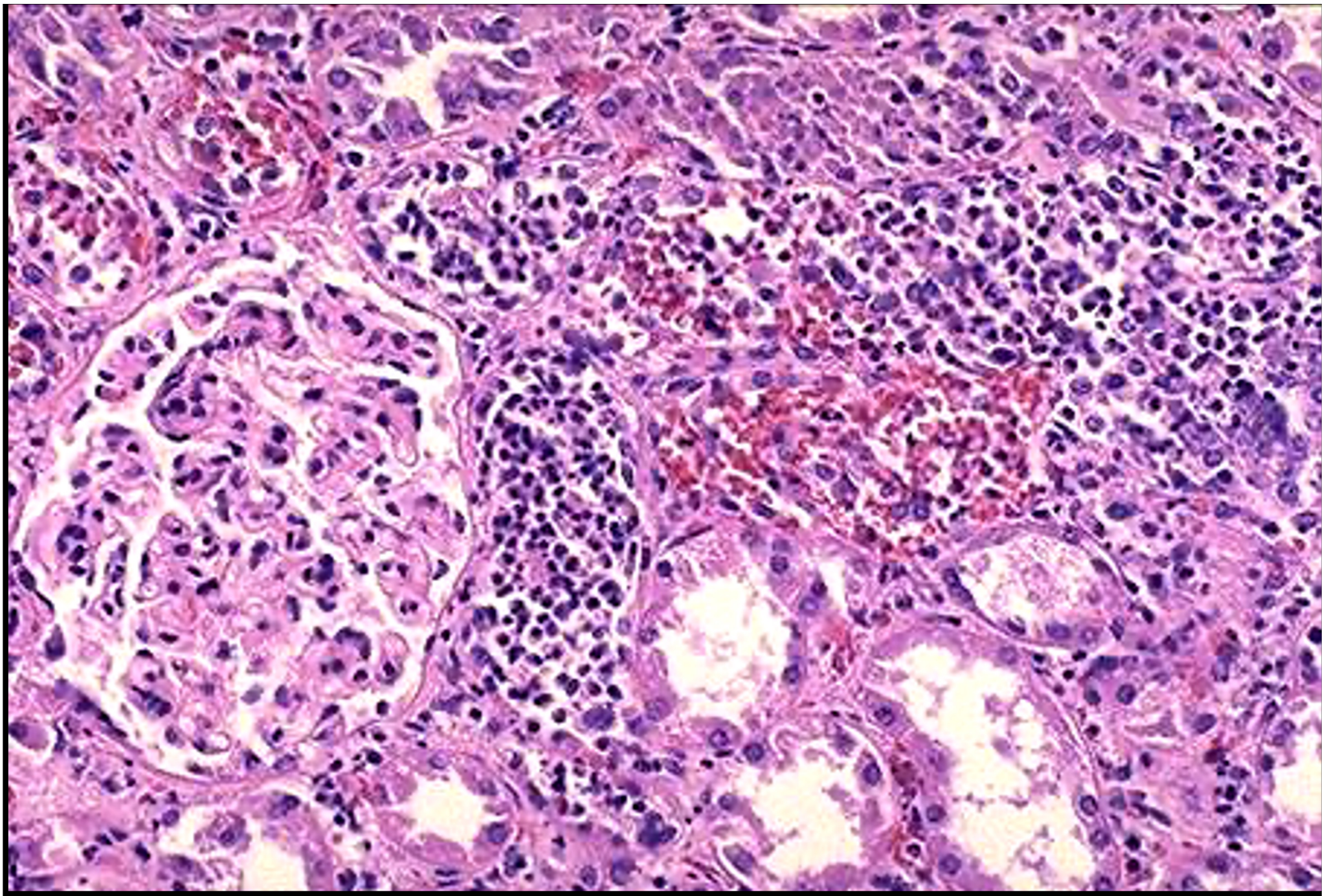
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 - Pyelonephritis

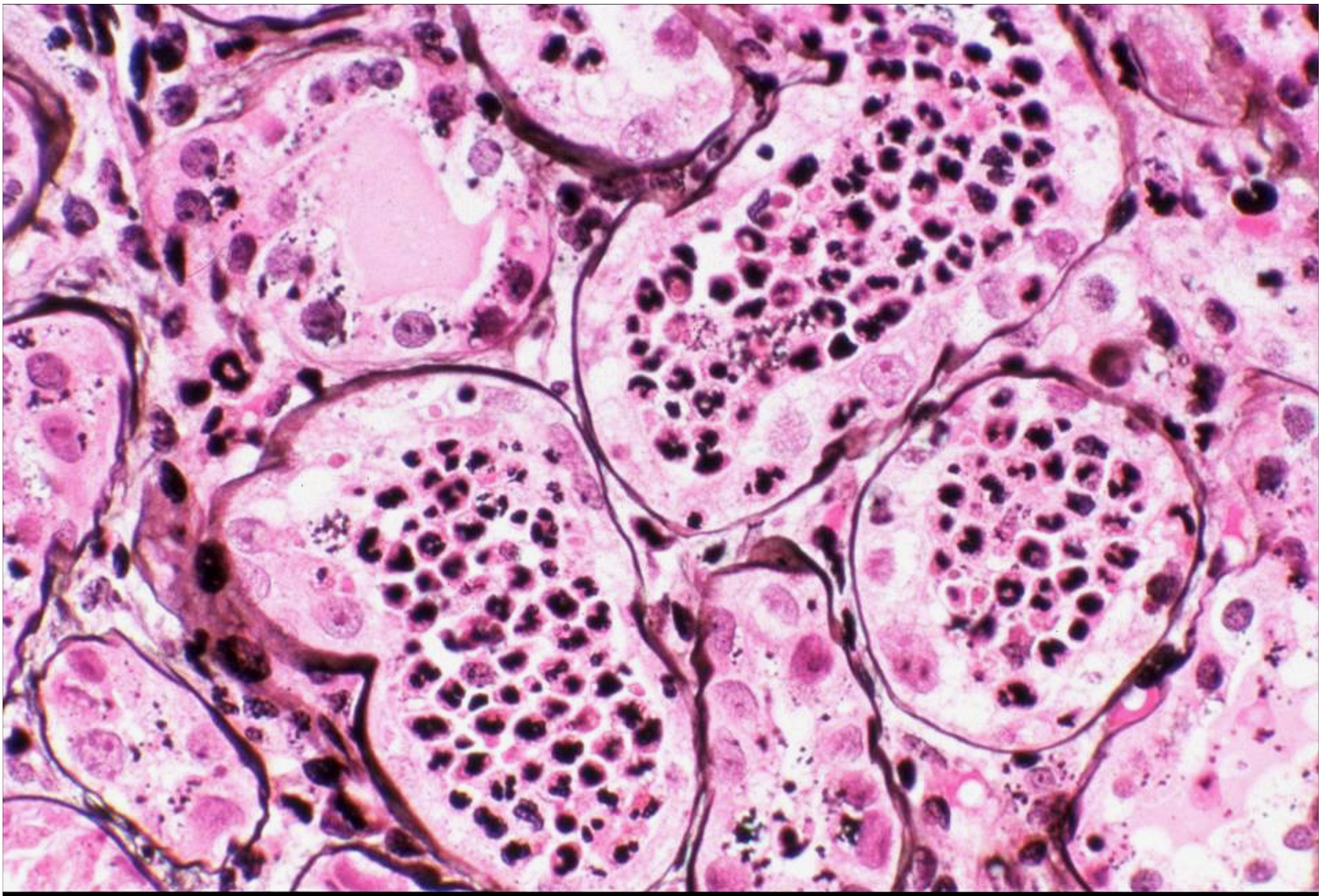
Pyelonephritis

Things You Must Know

- Invasive kidney infection
- Usually ascends from UTI
- Fever, flank pain
- Organisms: E. coli, Proteus



Acute pyelonephritis



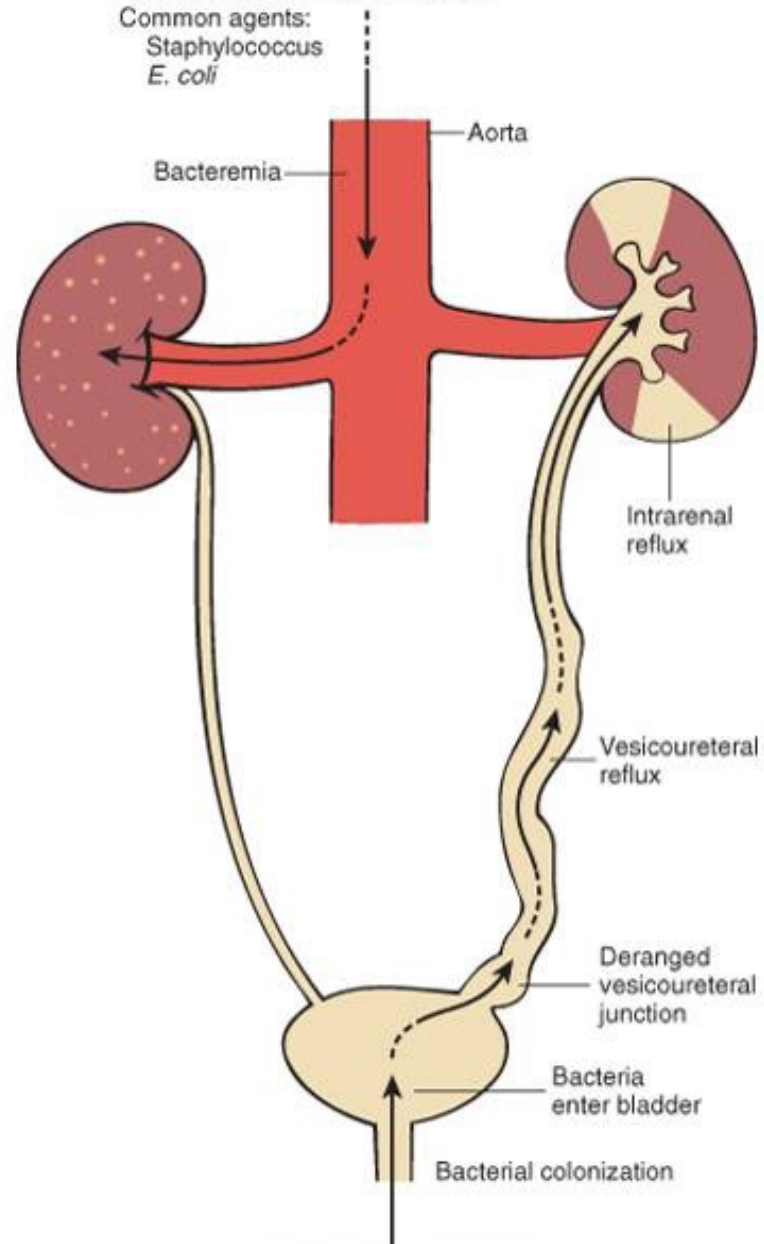
Acute pyelonephritis



Cellular cast

HEMATOGENOUS INFECTION

Common agents:
Staphylococcus
E. coli



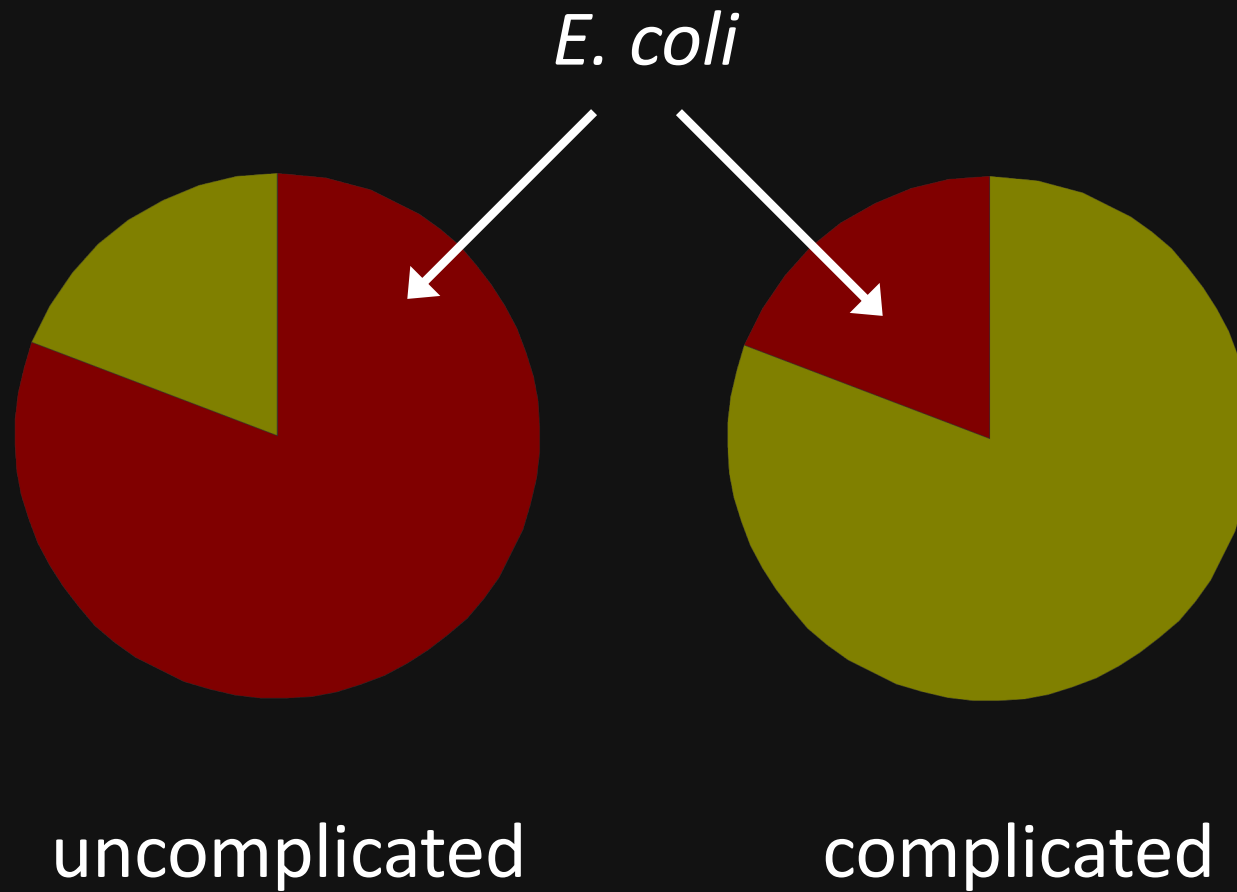
ASCENDING INFECTION

Common agents:
E. coli
Proteus
Enterobacter

Urinary Tract Infection

- Women, elderly
- Patients with catheters or malformations
- Dysuria, frequency
- Organisms: *E. coli*, *Proteus*

UTI: Common Bugs





Urinary catheter colonized by *Proteus*

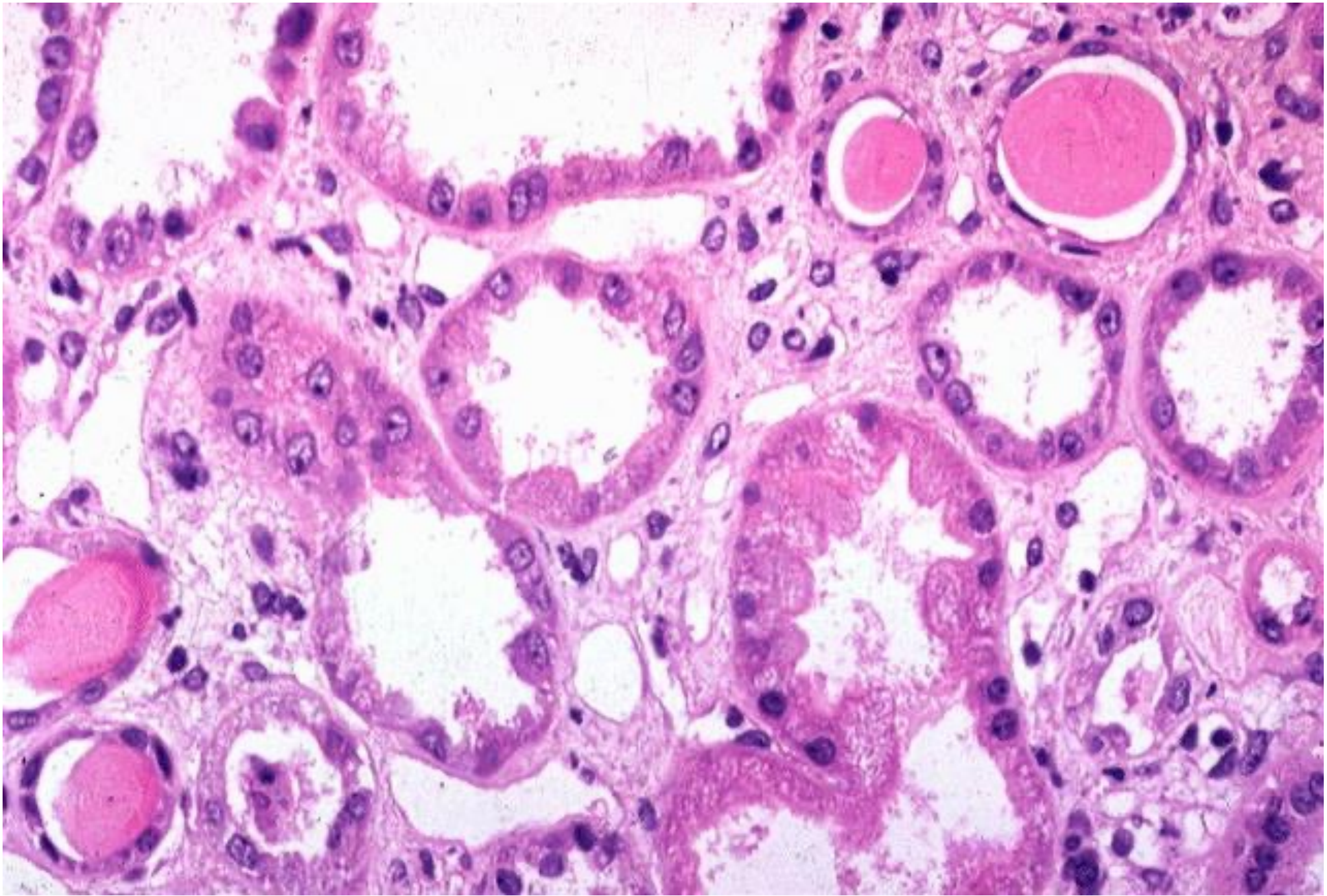
Renal Pathology Outline

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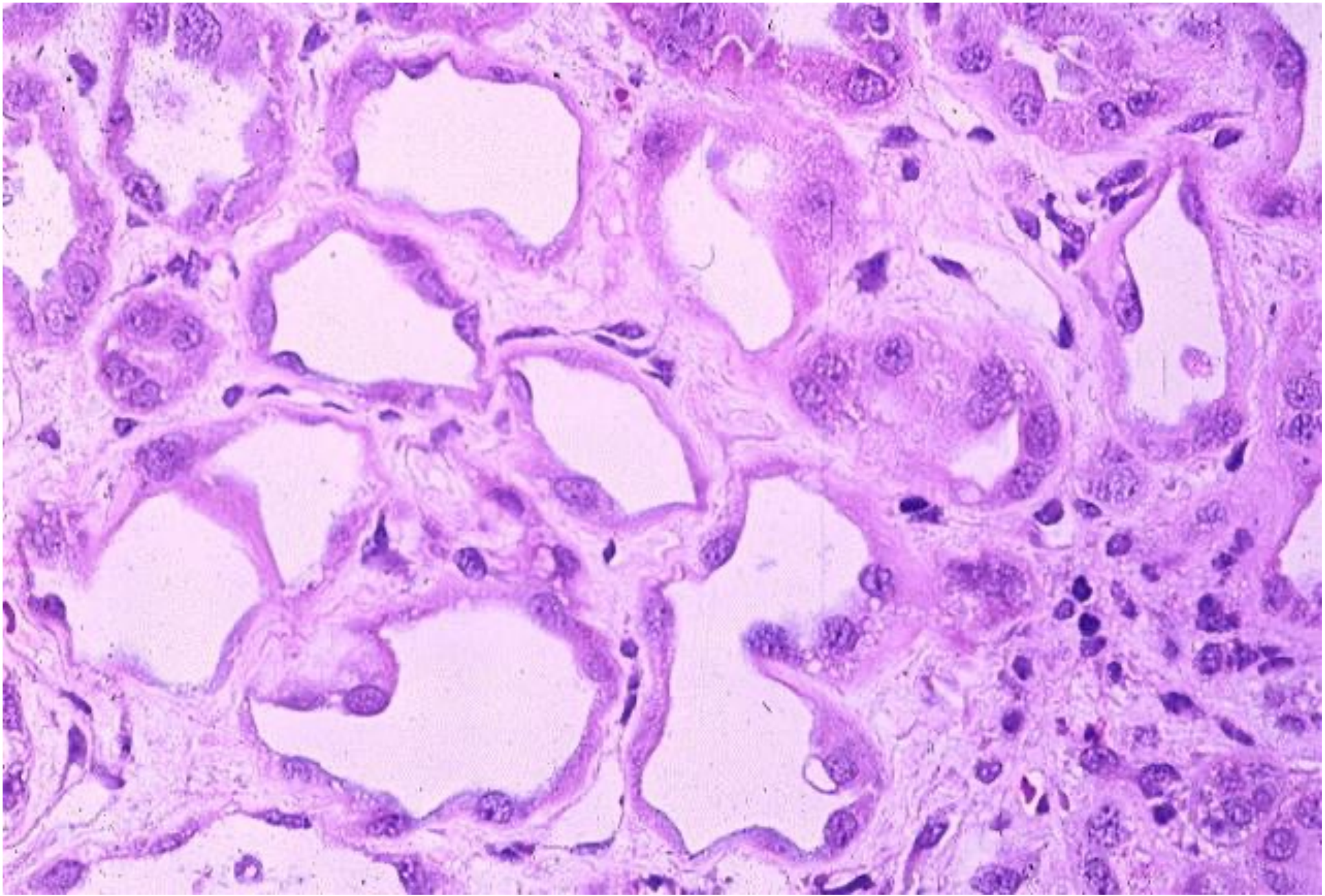
Acute Tubular Necrosis

Things You Must Know

- The most common cause of acute renal failure!
- Reversible tubular injury
- Many causes: ischemic (shock), toxic (drugs)
- Most patients recover



Acute tubular necrosis



Acute tubular necrosis

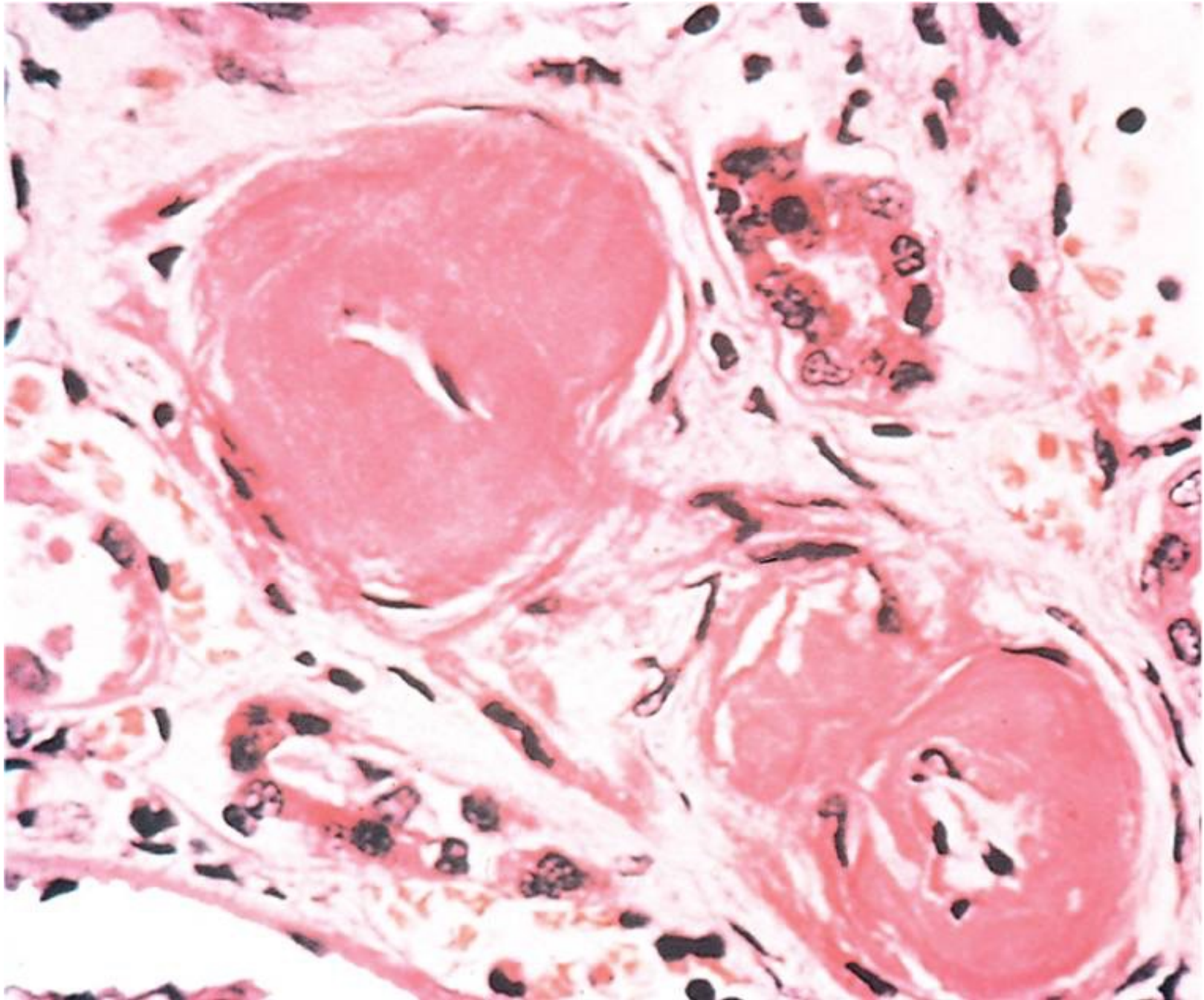
Renal Pathology Outline

- Introductory stuff
- Glomerular diseases
- Tubular and interstitial diseases
- Diseases involving blood vessels
 - Benign nephrosclerosis
 - Malignant nephrosclerosis

Benign Nephrosclerosis

Things You Must Know

- Found in patients with benign hypertension
- Hyaline thickening of arterial walls
- Leads to mild functional impairment
- Rarely fatal



Benign nephrosclerosis

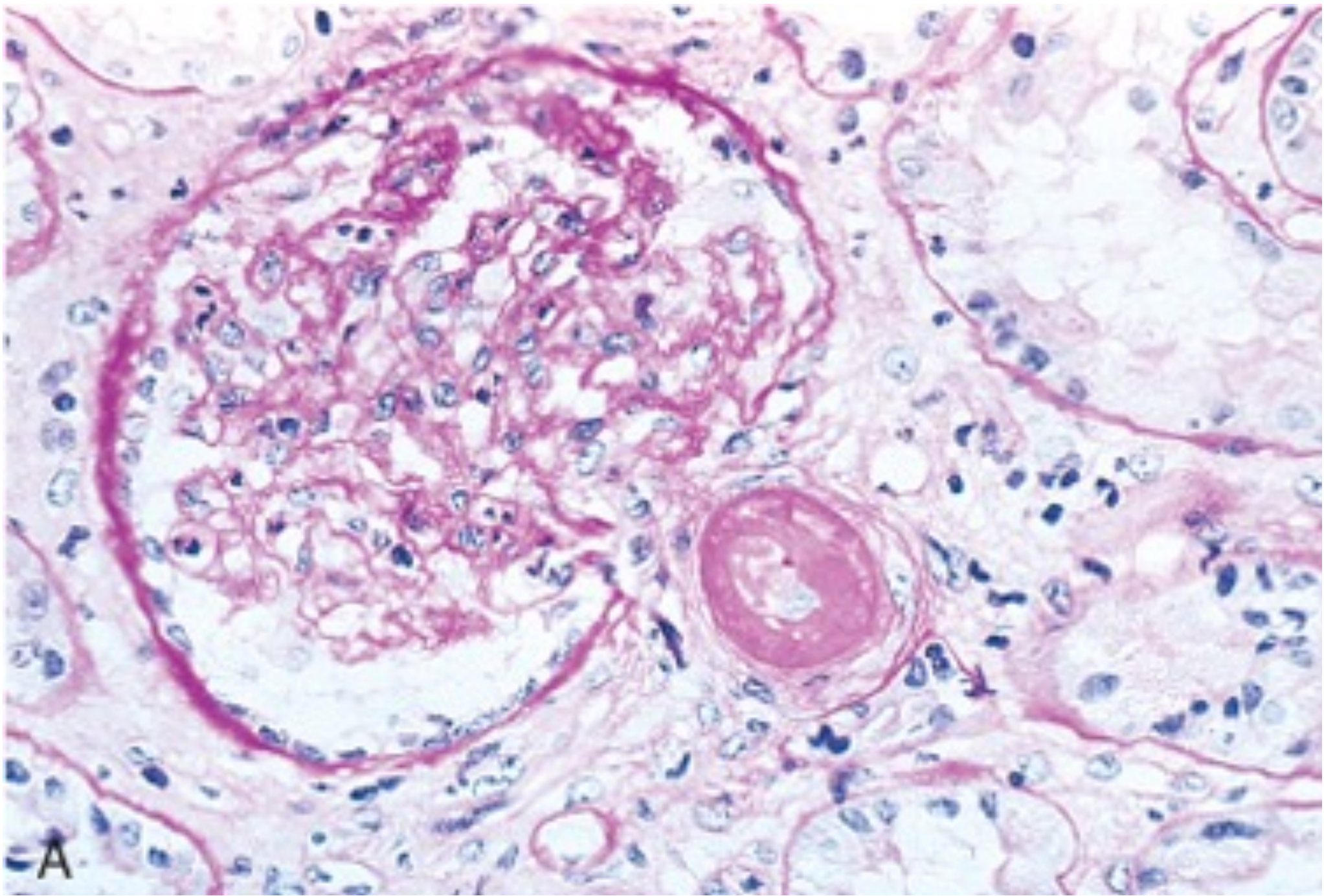
Malignant Nephrosclerosis

Things You Must Know

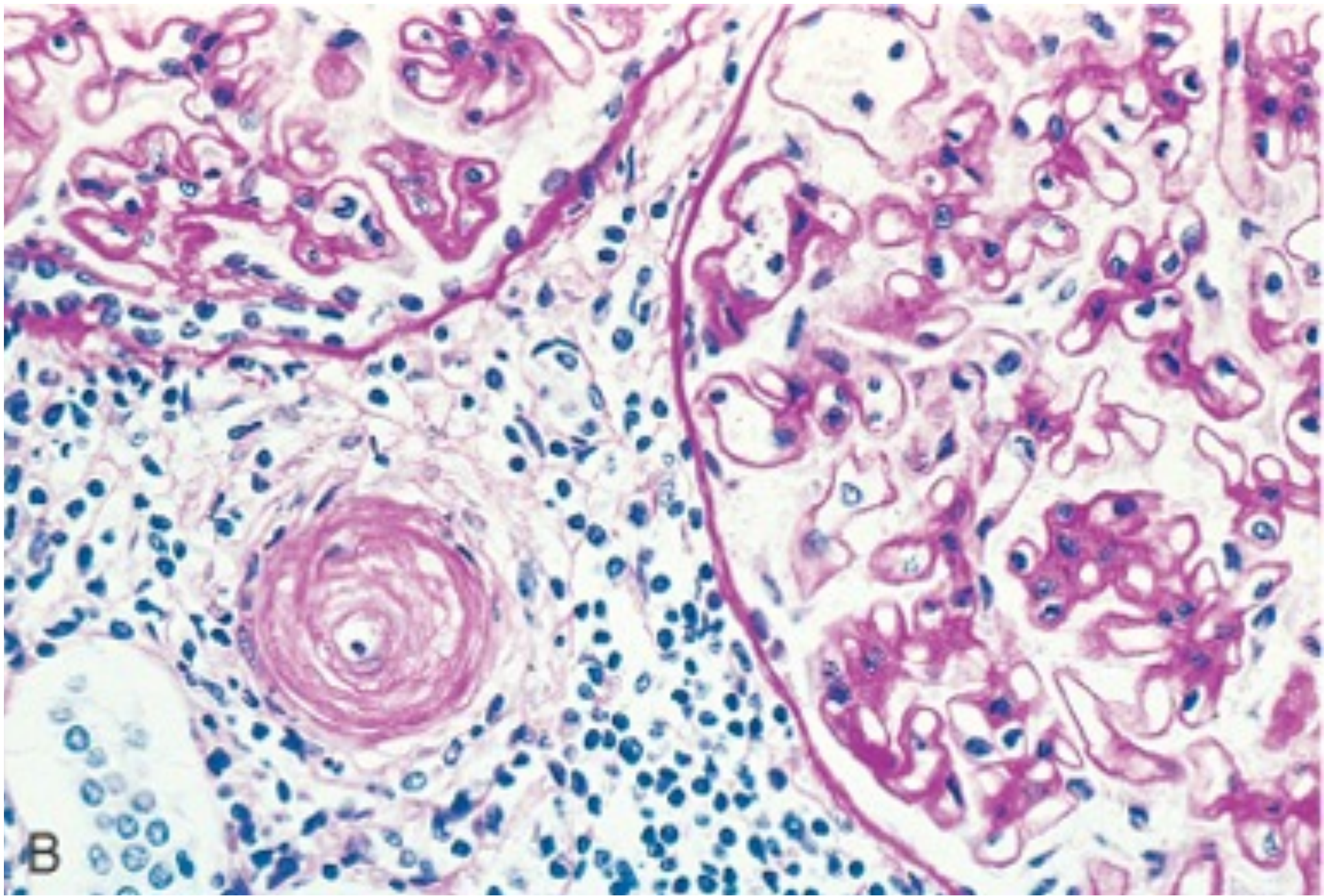
- Arises in malignant hypertension
- Hyperplastic vessels
- Ischemia of kidney
- Medical emergency

Malignant Hypertension

- 5% of cases of hypertension
- Super-high blood pressure, encephalopathy, heart abnormalities
- First sign often headache, scotomas
- Decreased blood flow to kidney leads to increased renin, which leads to increased BP!
- 5y survival: 50%



Malignant nephrosclerosis



Malignant nephrosclerosis

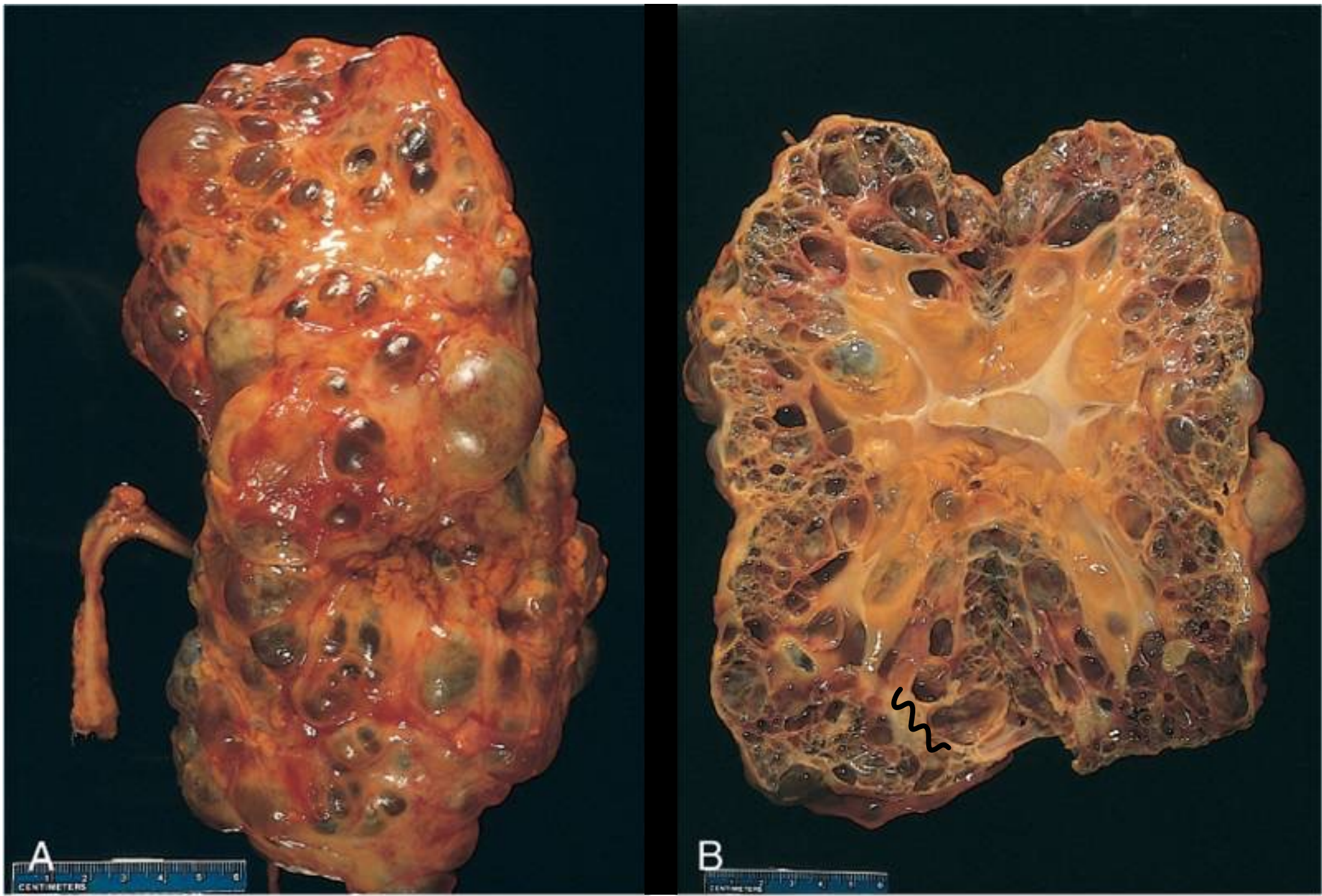
Renal Pathology Outline

- Introductory stuff
- Glomerular diseases
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- Diseases involving blood vessels
- Cystic diseases
 - Adult polycystic kidney disease
 - Childhood polycystic kidney disease

Adult Polycystic Kidney Disease

Things You Must Know

- Autosomal dominant
- Huge kidneys full of cysts
- Usually no symptoms until 30s
- Associated with brain aneurysms



Adult polycystic kidney disease

Childhood Polycystic Kidney Disease

Things You Must Know

- Autosomal recessive
- Numerous small cortical cysts
- Associated with liver cysts
- Patients often die in infancy



Childhood polycystic kidney disease

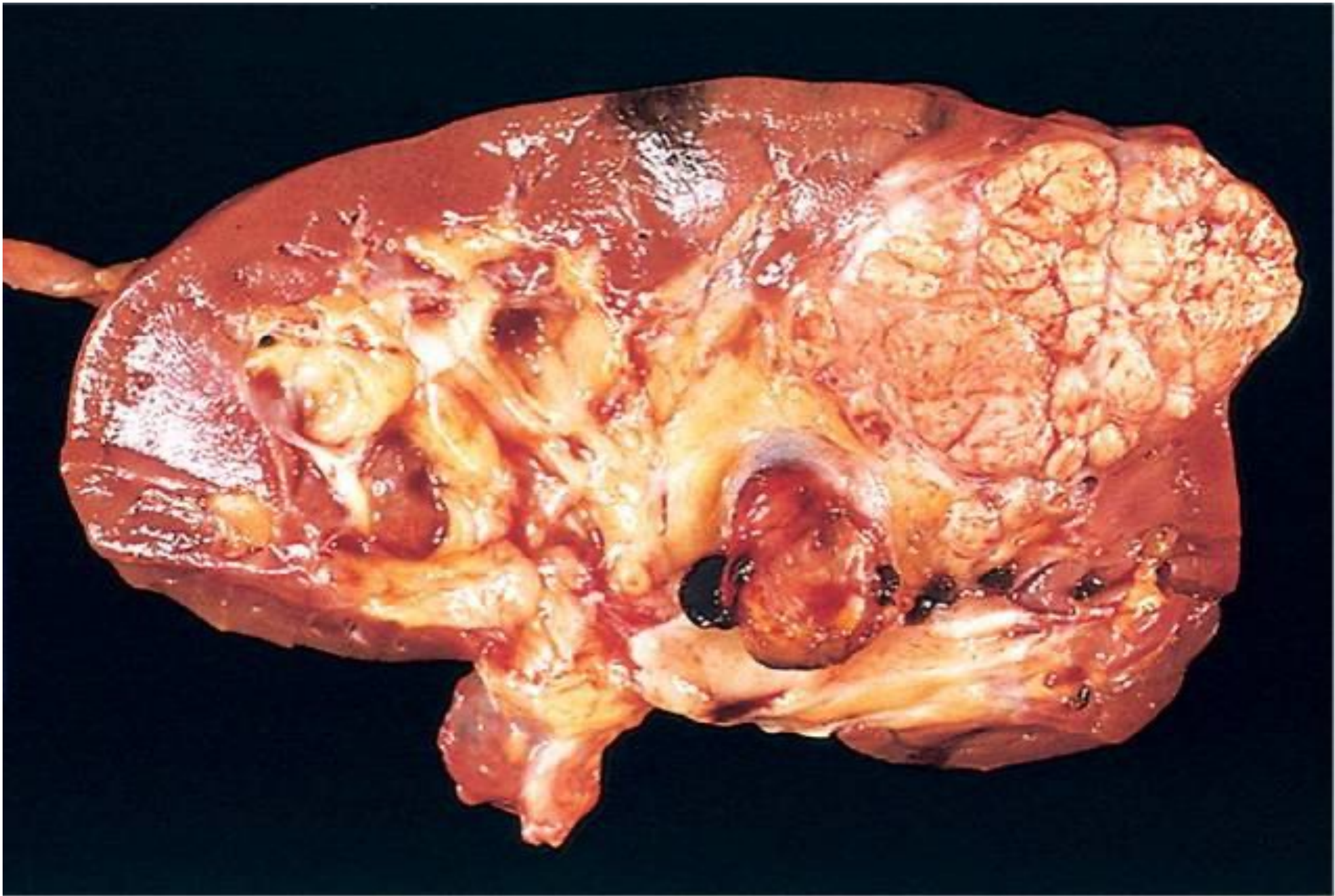
Renal Pathology Outline

- Introductory stuff
- Glomerular diseases
- Tubular and interstitial diseases
- Diseases involving blood vessels
- Cystic diseases
- Tumors
 - Renal cell carcinoma
 - Bladder carcinoma

Renal Cell Carcinoma

Things You Must Know

- Derived from tubular epithelium
- Smoking, hypertension, cadmium exposure
- Hematuria, abdominal mass, flank pain
- If metastatic, 5y survival = 5%

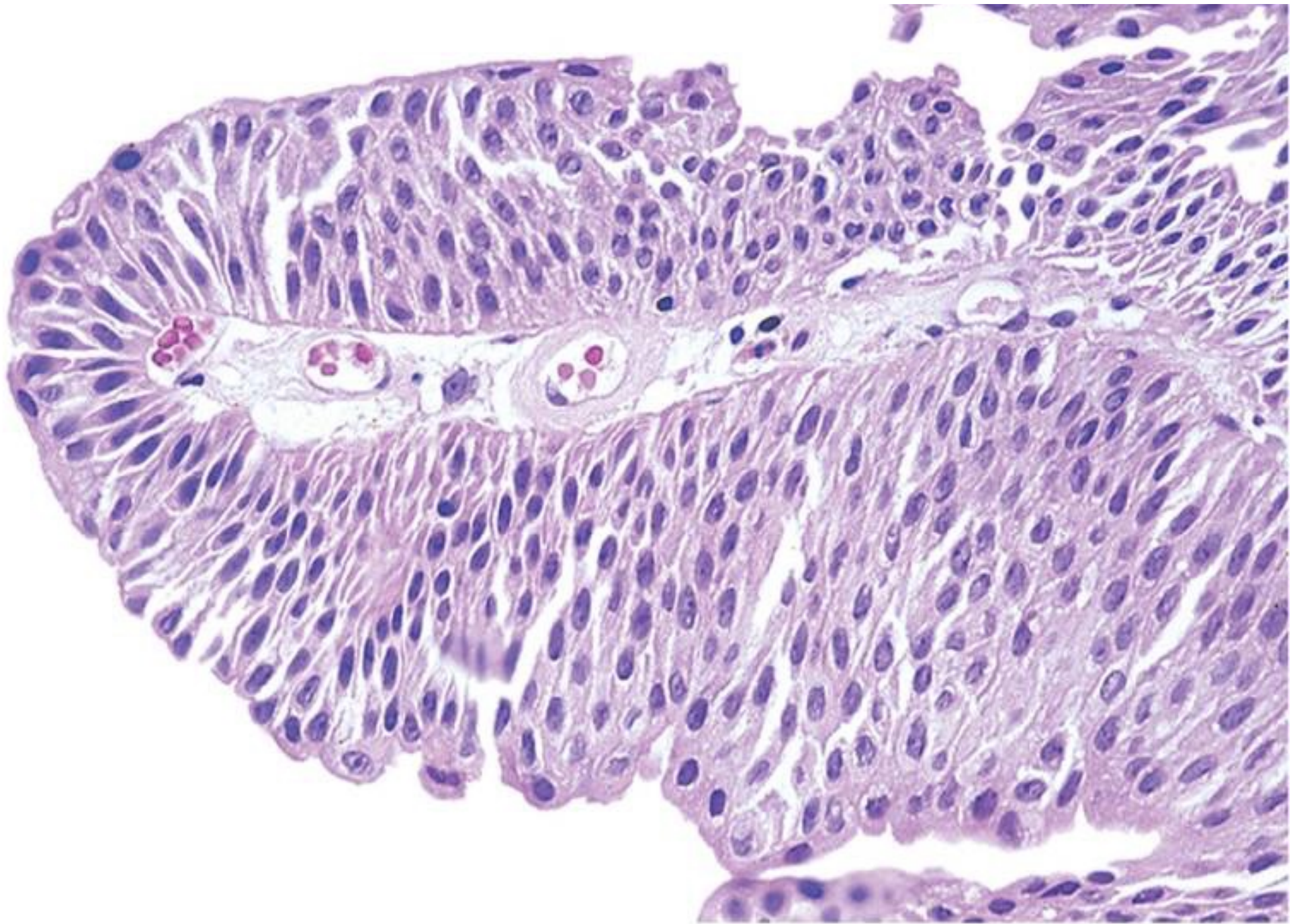


Renal cell carcinoma

Bladder Carcinoma

Things You Must Know

- Derived from transitional epithelium
- Presents with painless hematuria
- Prognosis depends on grade and depth of invasion
- Overall 5y survival = 50%



Bladder carcinoma

Renal Pathology Outline

- Introductory stuff
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- Diseases involving blood vessels
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- Tumors