Pathology of the kidney

Histology practice

Pyelonephritis

- Inflammation of the renal parenchyma and renal pelvis
- Origin of microbes:
  - hematogenous spread (rare)
  - ascending infections
    -> risk factors:
      - urinary tract obstruction
      - vesicoureteral reflux
      - urinary tract interventions, catheter
      - women
      - diabetes mellitus, immunosuppression
      - sexual activity

Common microbes in acute pyelonephritis

Ascending infections (90%)

- E. coli
- Proteus species
- Klebsiella
- Enterobacter
- Pseudomonas

Hematogenous infections:

- Staphylococcus
- Streptococcus species

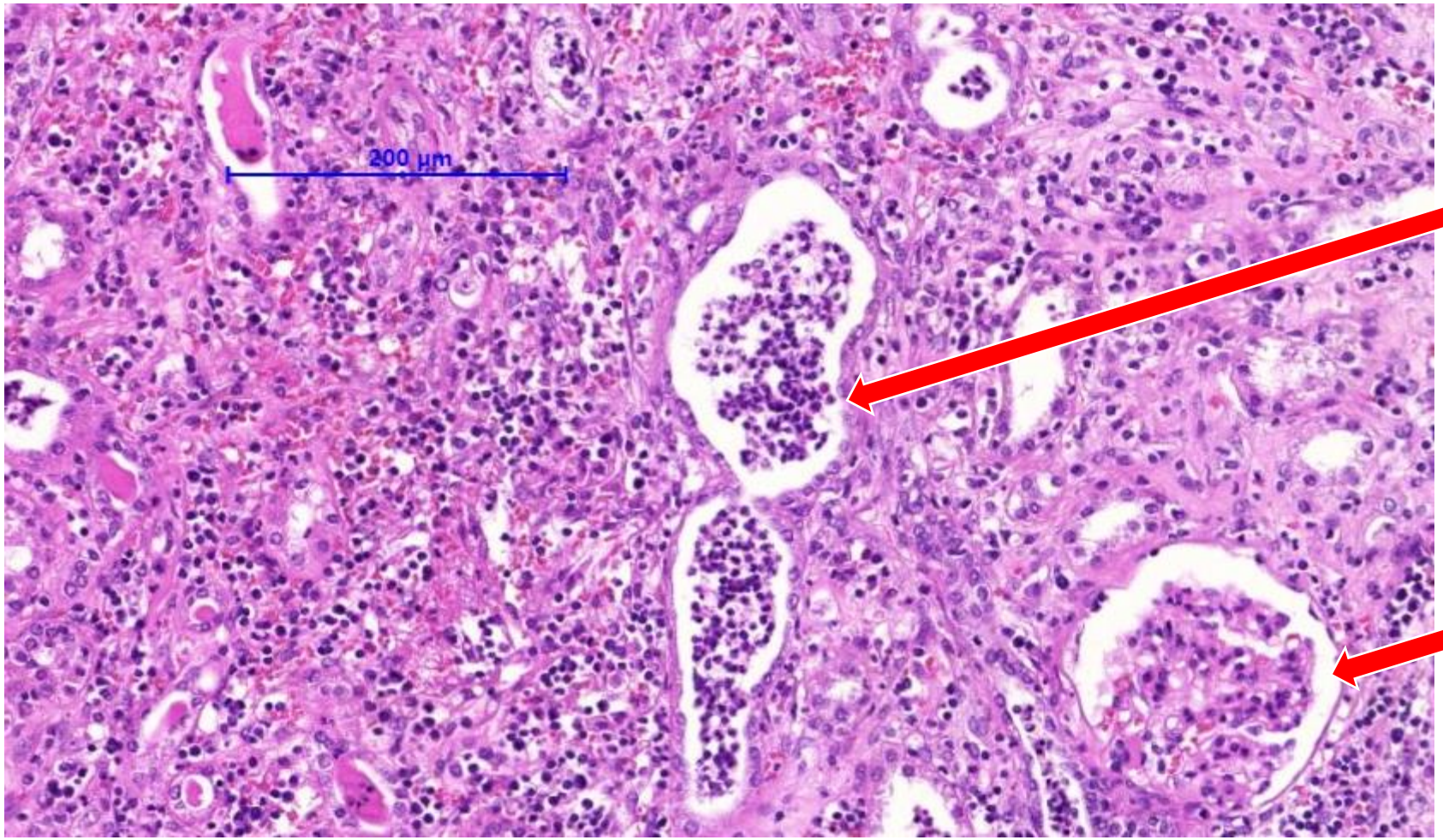
Presentation of acute pyelonephritis

summary

- Unilateral or bilateral
- Frequent urination, dysuria
- Pyuria and bacteriuria, white blood cell cylinders in the urine
- Purulent inflammation of renal parenchyma, necrosis
- Abscesses (multiple)
- Severe form (rare): papillary necrosis! (ischemia + purulent inflammation)
  pyonephrosis (the renal pelvis and the ureter is filled with pus)

Microscopic appearance

ascending infection



- **Acute inflammation in renal tubules and in the interstitium (neutrophil granulocytes, white blood cell cylinders)**
- **Preserved glomerulus**

End stage kidney

- Irreversible destruction of renal function that leads to complete loss of renal function

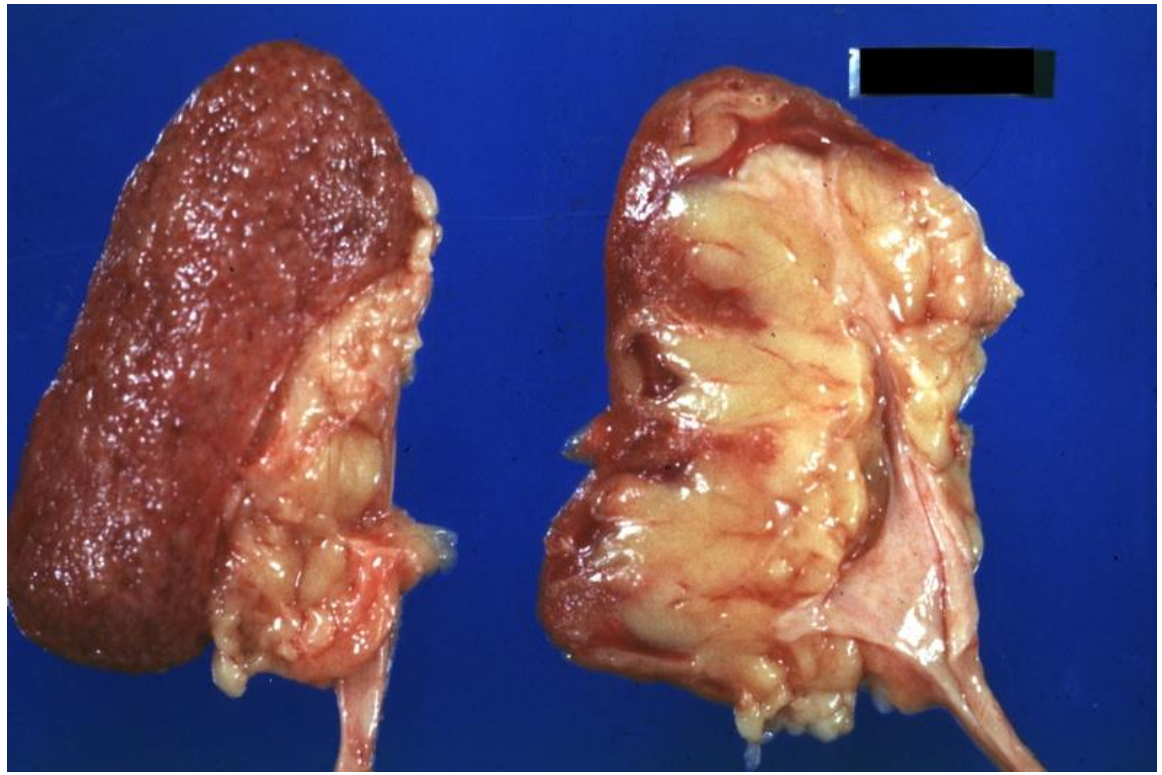
  Causes:

  - immunemediated inflammation (glomerulonephritis)
  - recurrent pyelonephritis
  - diabetes mellitus
  - hypertension
  - rarely: hereditary diseases

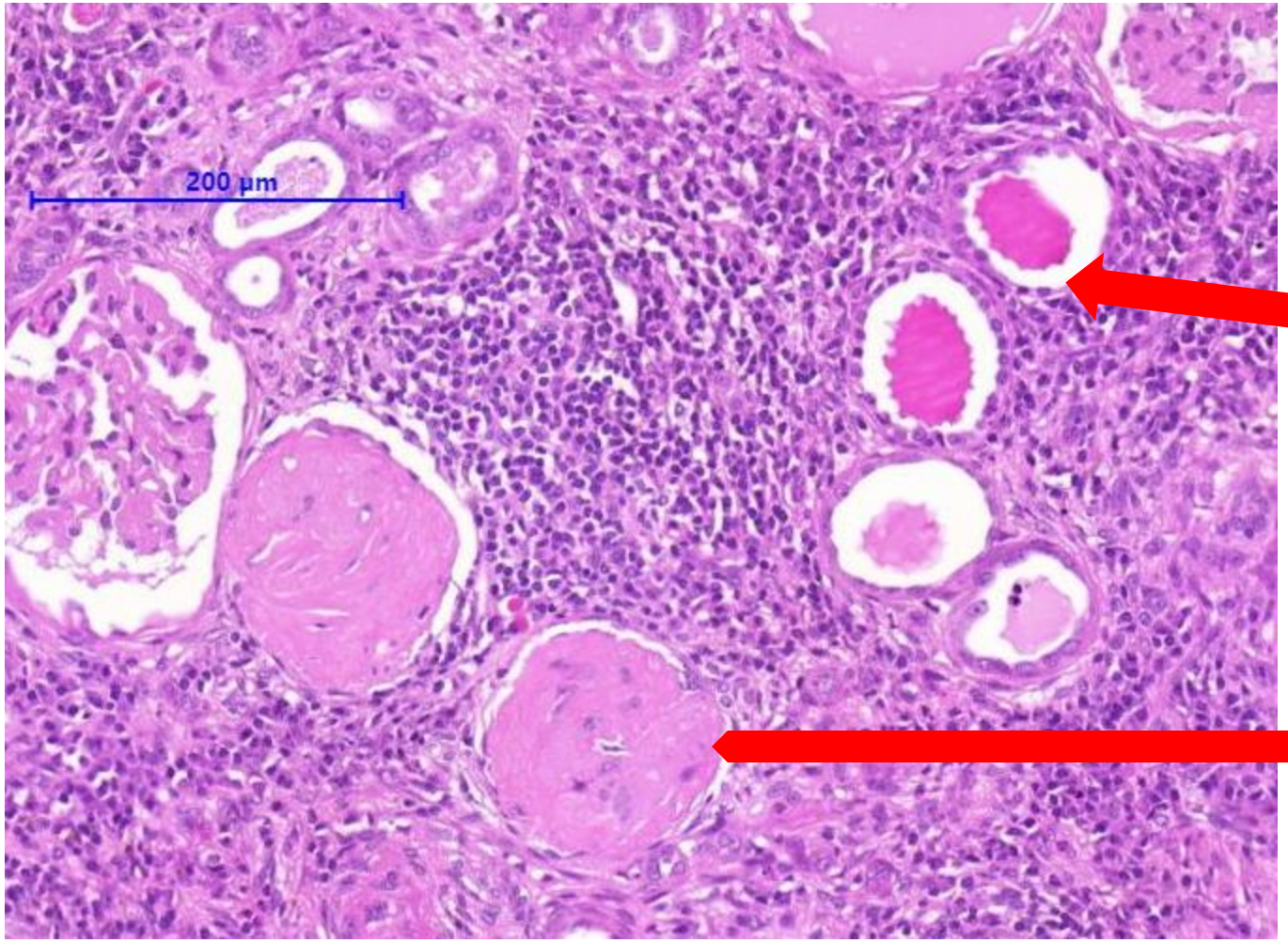
Clinically = advanced stage of chronic renal failure

Presentation

- The kidneys are shrunken
- Compensatory increase of renal pelvis fat *or* hydronephrotic kidney
- Firm
- **Scarring** on the surface, irregularity
- The cortex is thin



Microscopic appearance



- Interstitial fibrosis and chronic inflammation
- Protein cylinders
- Tubular atrophy
  - Thyreoidisation
  - Endocrine type
  - Classic
- Sclerotic glomeruli

Renal biopsy

- Applied since 1944 (Alwall)

Indication:

- Diagnosis of the disease
- Assessment of activity and severity of a previously diagnosed disease
- Assessment of prognosis
- Assessment of response to a specific therapy

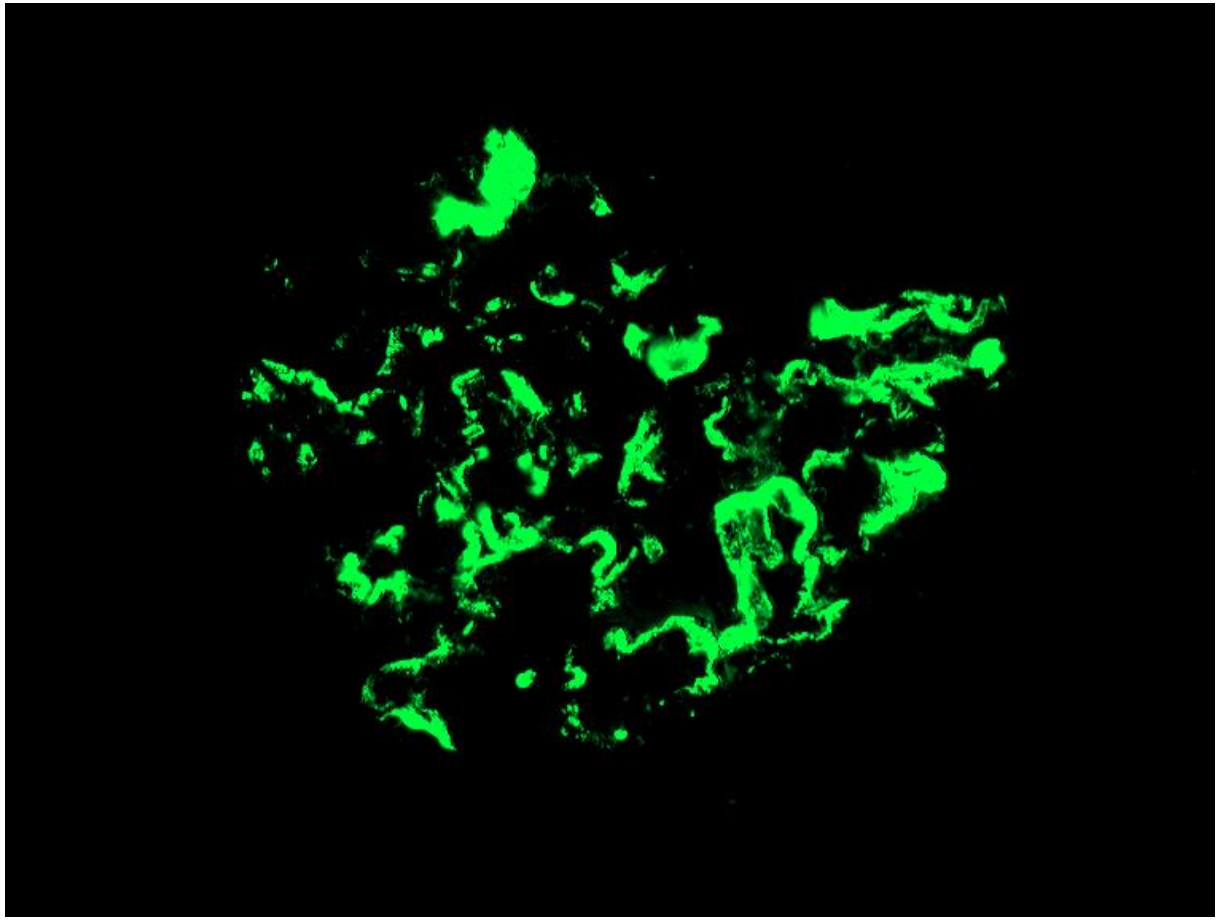
Indication of renal biopsy

- Nephrotic syndrome (most common)
- Acute nephritis syndrome (diff.dg.)
- Renal failure of unknown origin (if the kidney has normal US morphology)
- Hematuria (glomerular, with dysmorphic RBCs)
- Renal failure of transplanted kidney
- Renal progression of a systemic disease
  Ex. systemic lupus erythematosus, amyloidosis

Pathologic work-up of renal biopsies

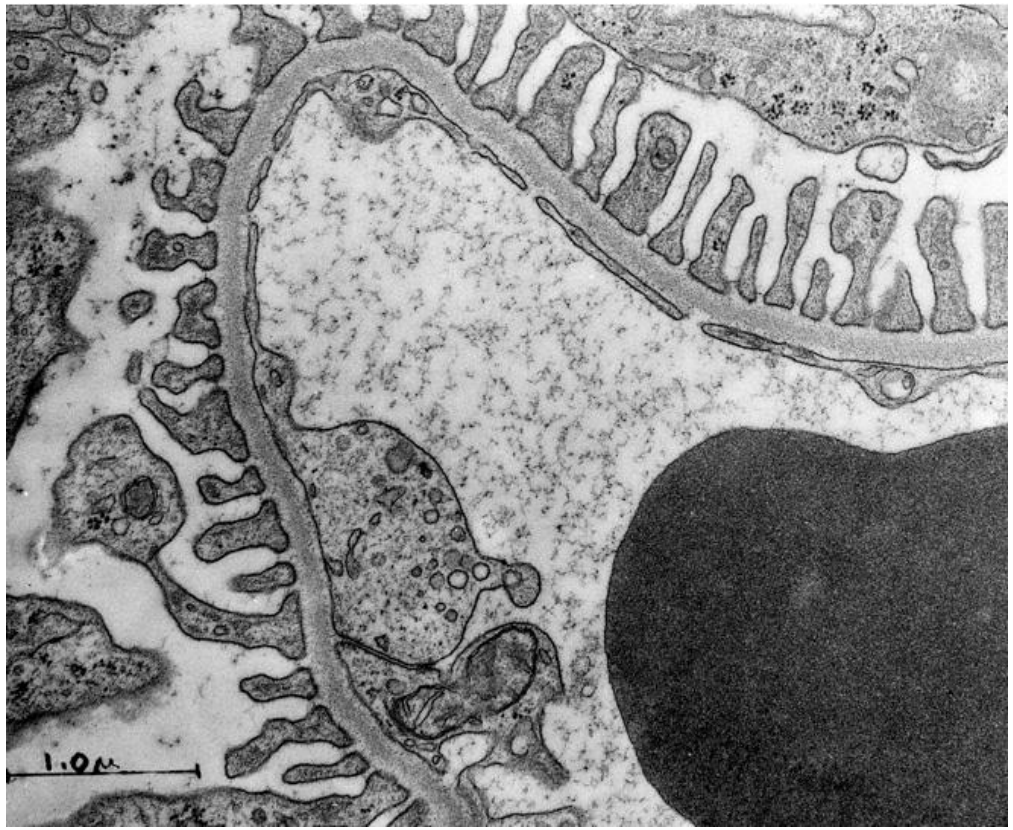
- The biopsy must contain at least 14 glomerulus
- Routine histological examination (min. 10 gl.):
  PAS, trichrome stain, silver impregnation,
  Congo red, van Gieson
- Immunofluorescent examination (min. 3 gl.):
  kappa and lambda light chain proteins, IgG / A / M,
  components of complement system: C3, C1q, C4
- Electronmicroscopy (min. 1 gl.)

Immunofluorescent image of IgA nephropathy (Berger's disease)

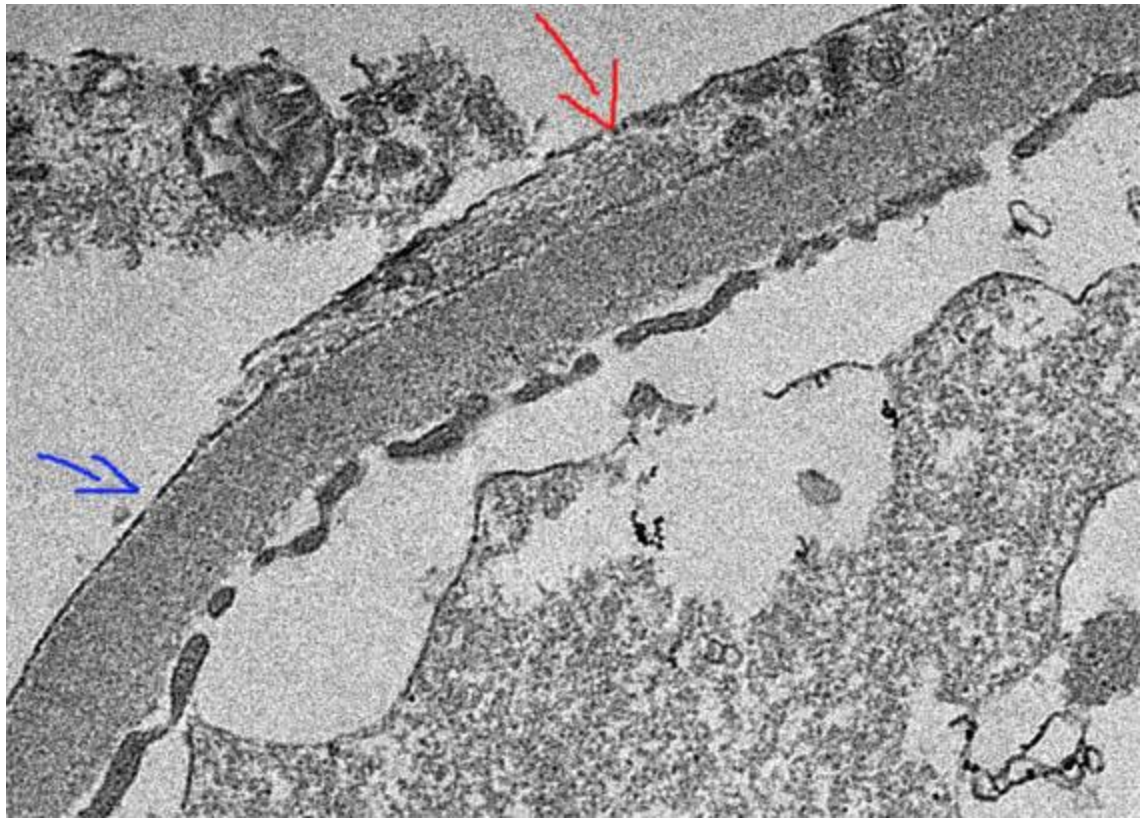


Intense, granular immuncomplexes in the mesangial region

Electronmicroscopic image of minimal change disease



Normal structure – preserved food process of the podocyte



Minimal change disease – foot process effacement of the podocyte

Renal biopsy

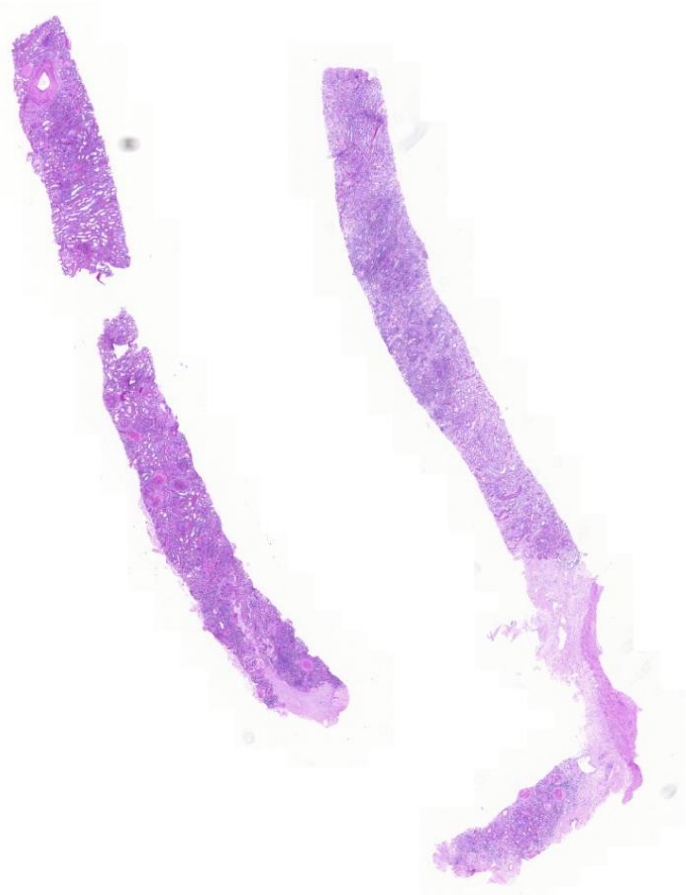
Case report

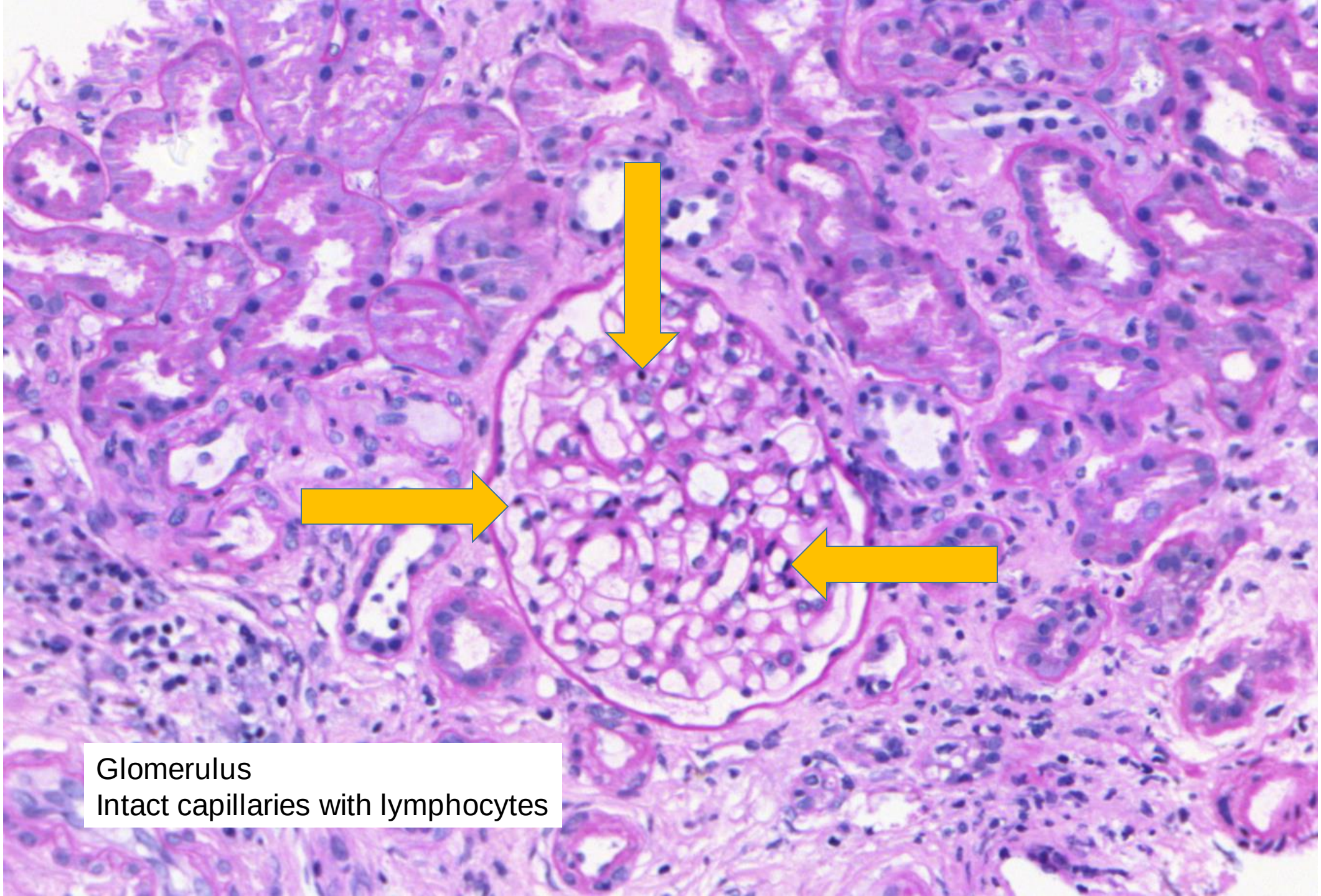
62 year old woman

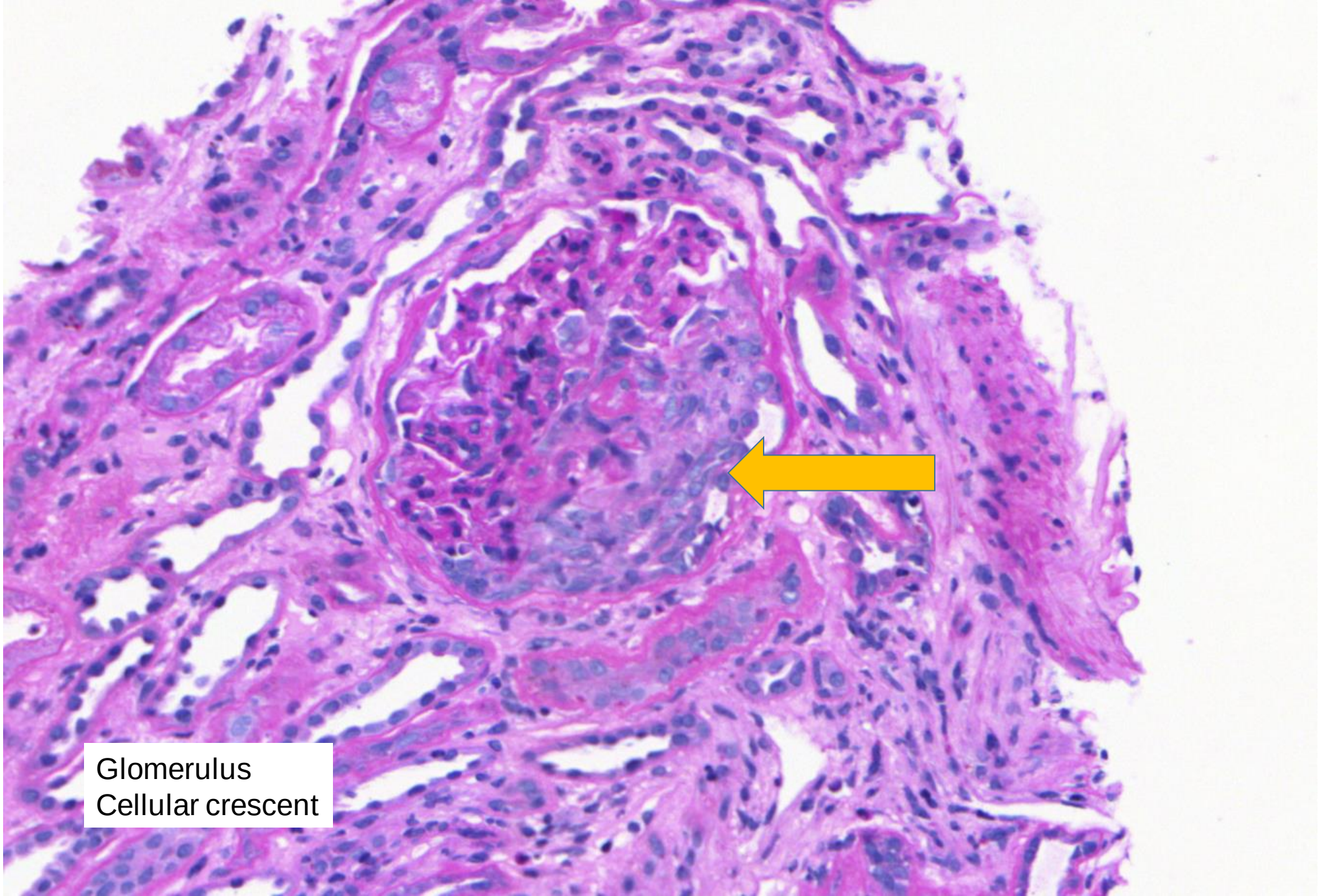
- Long history of hypertension

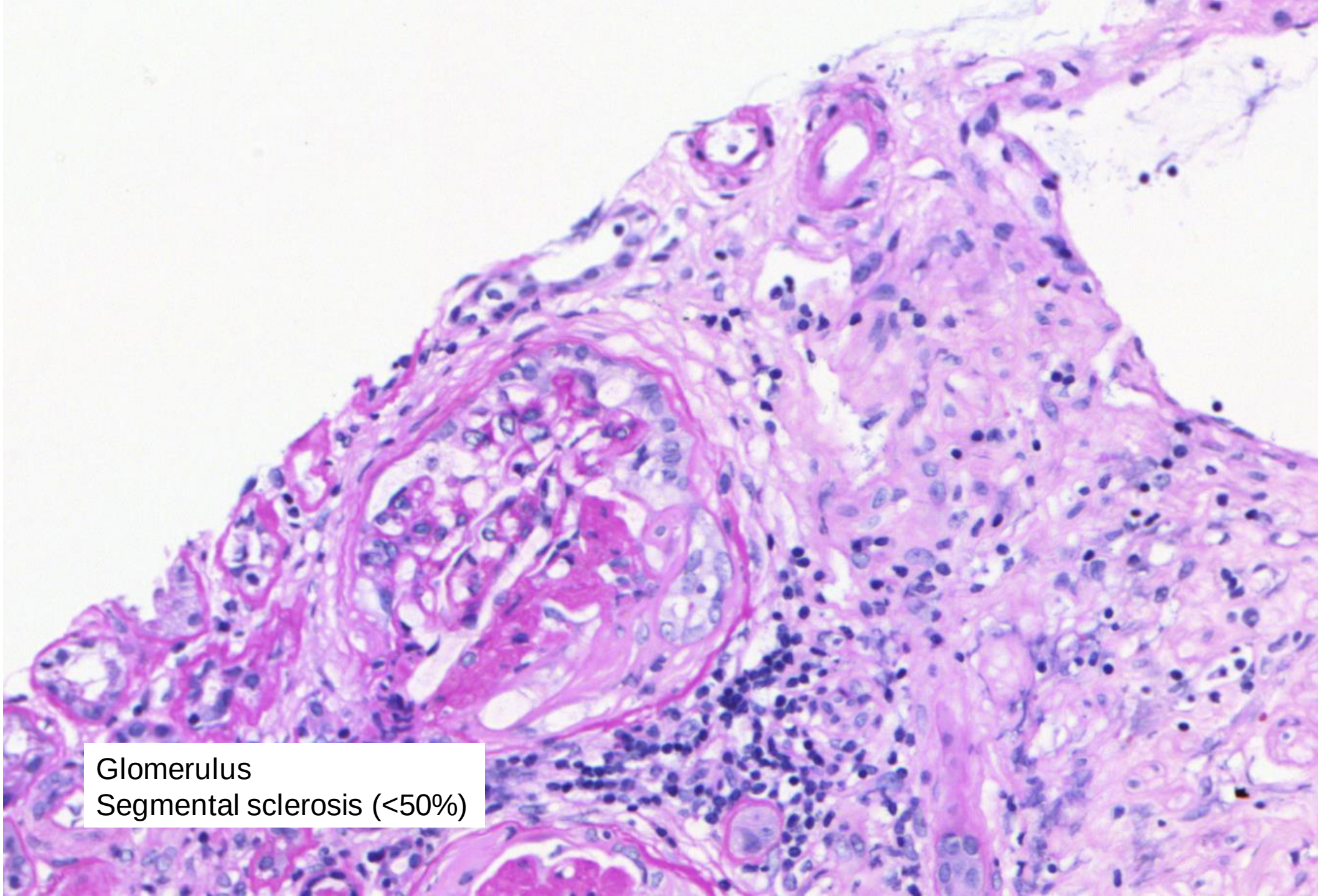
- Acute renal failure (creatinin: 243, GFR: 18)
- Microhematuria
- Proteinuria

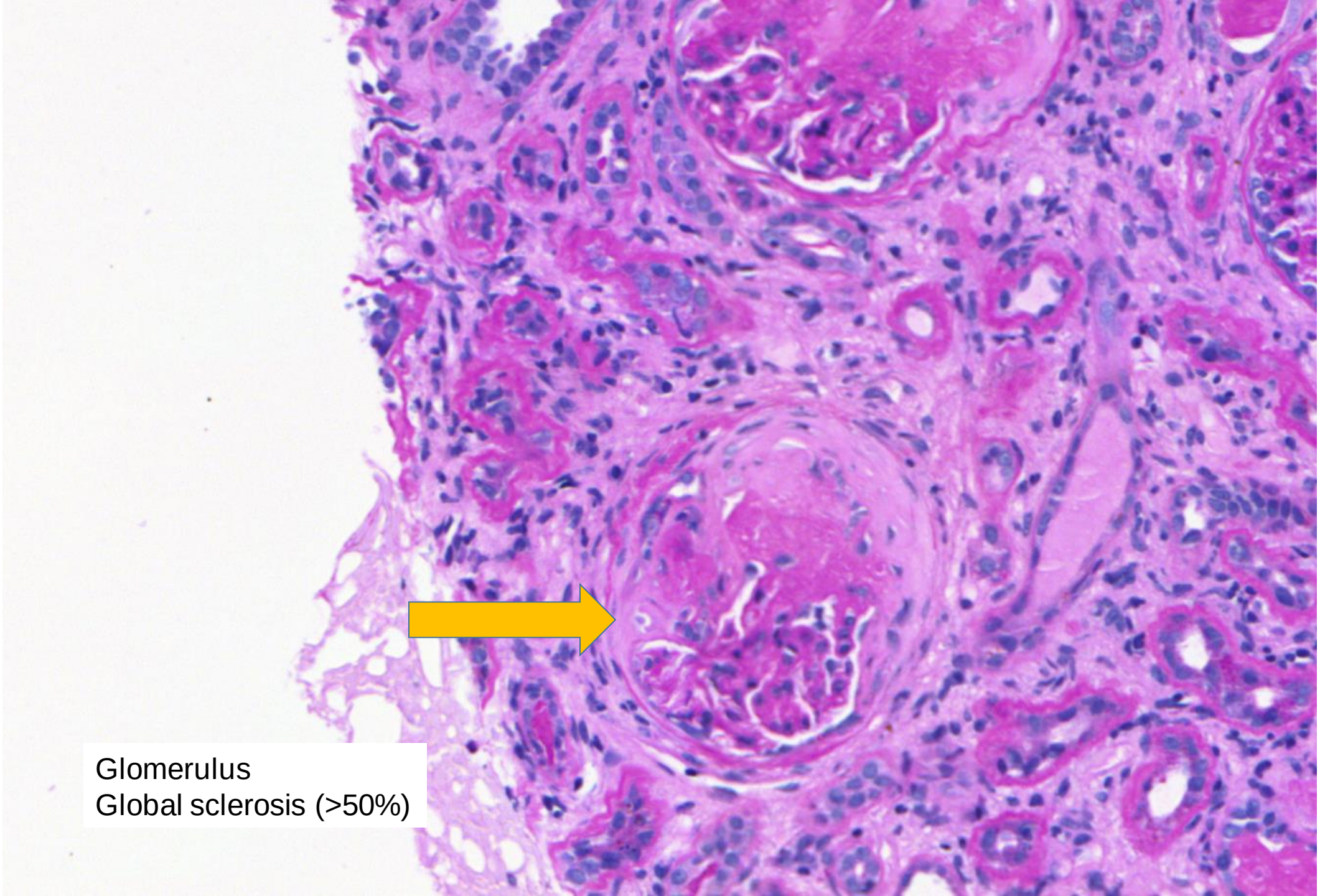
PAS



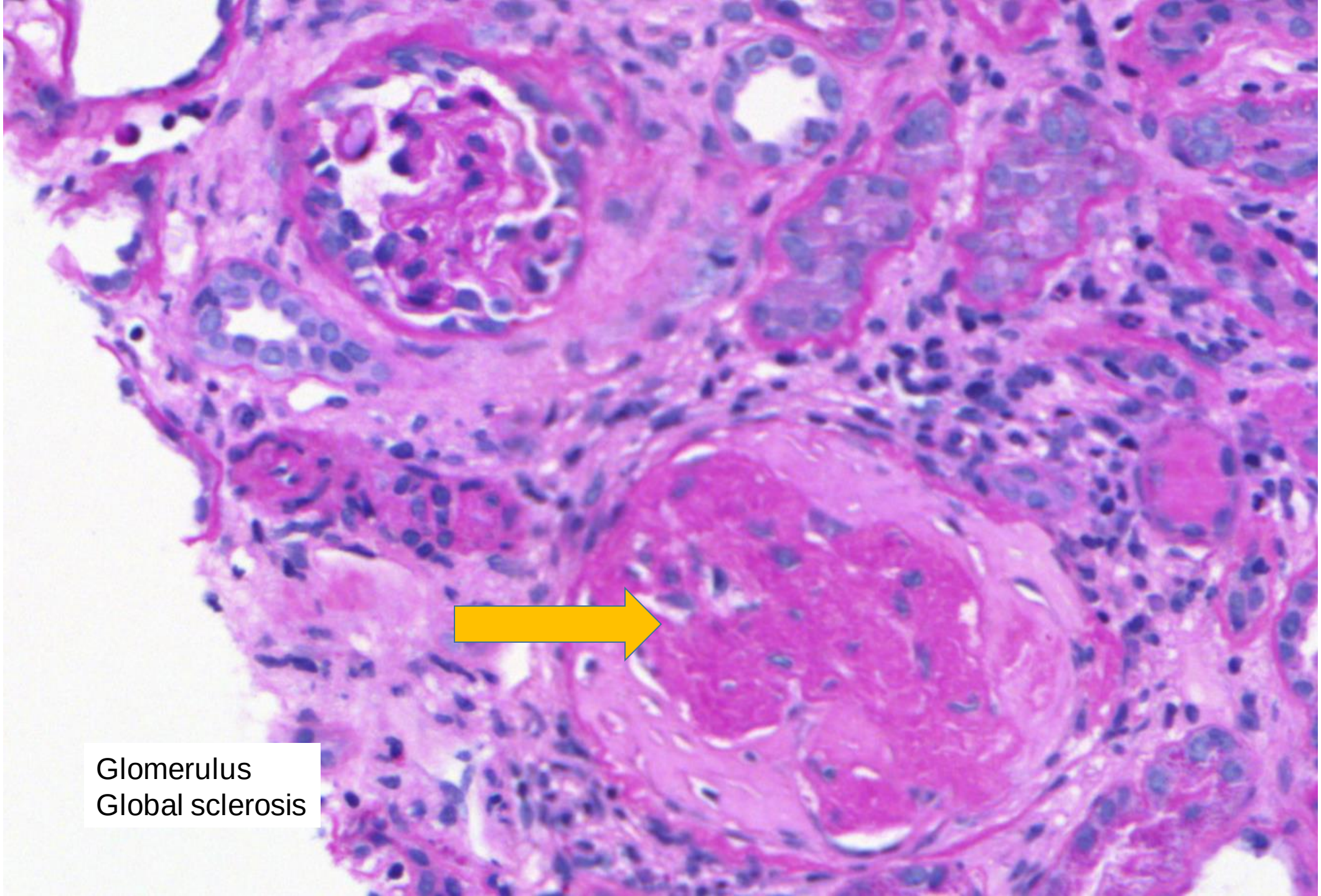

Glomerulus
Intact capillaries with lymphocytes

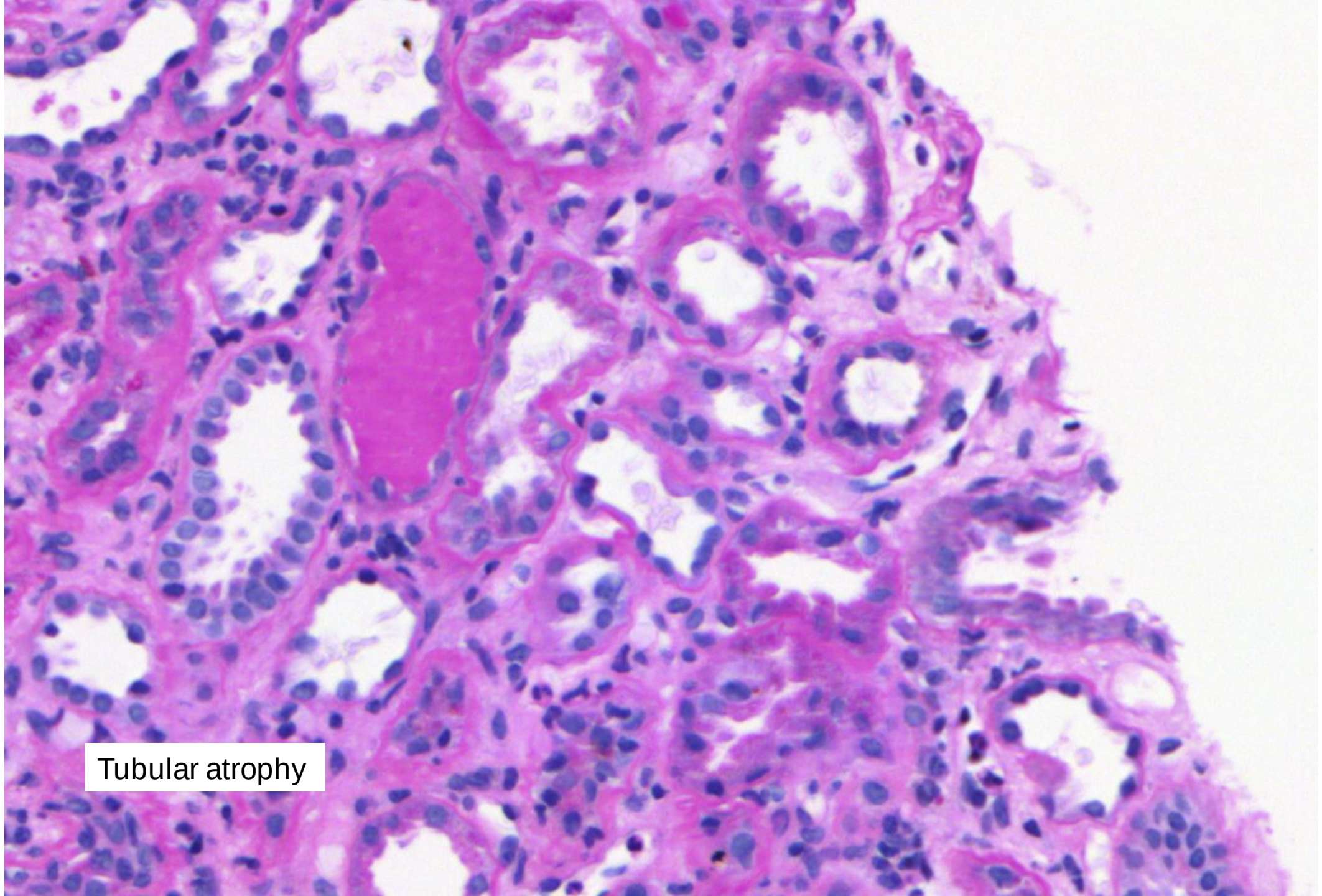

Glomerulus
Cellular crescent

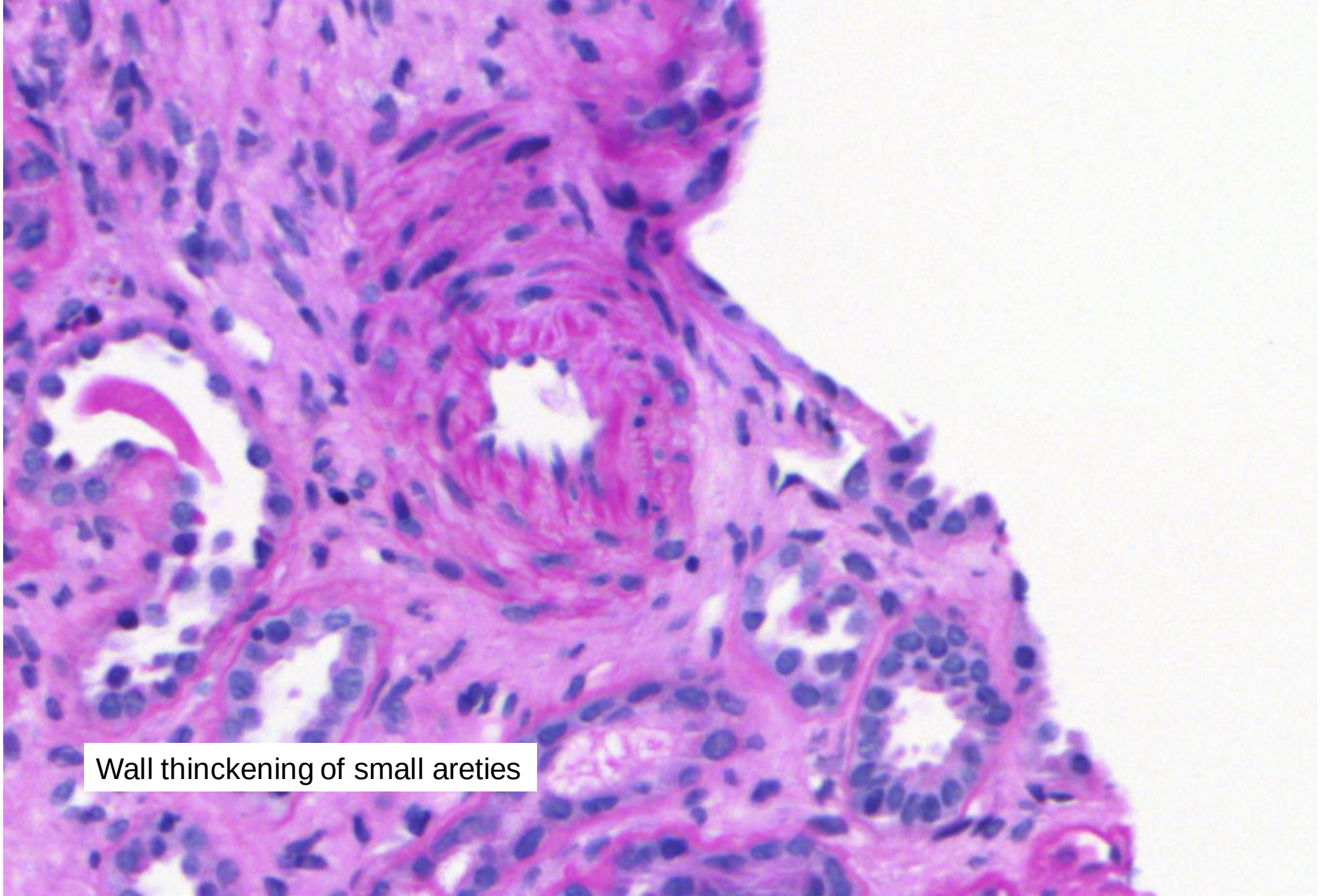

Glomerulus
Segmental sclerosis (<50%)

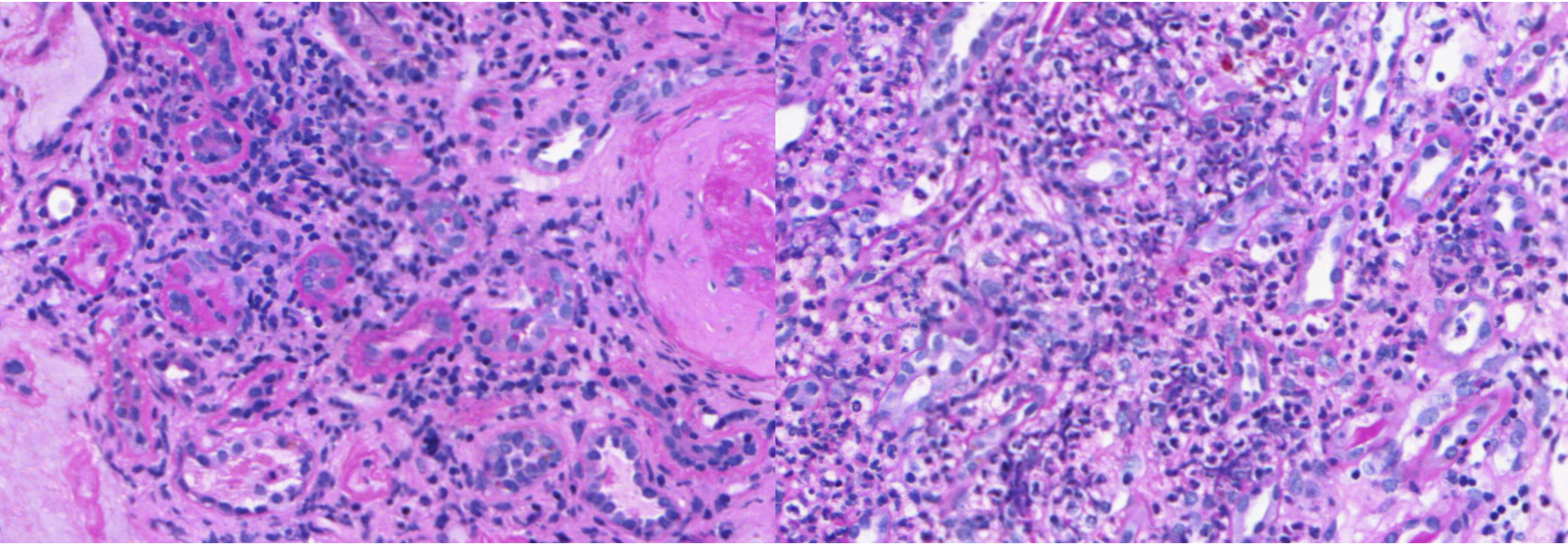


Glomerulus
Global sclerosis (>50%)


Glomerulus
Global sclerosis


Tubular atrophy


Wall thinckening of small areties



Interstitium – inflammation (lymphocytes and neutrophils)

Renal neoplasms

Most common benign tumors

- Papillary adenoma
- Oncocytoma
- Angiomyolipoma

Renal neoplasms

Malignant tumors

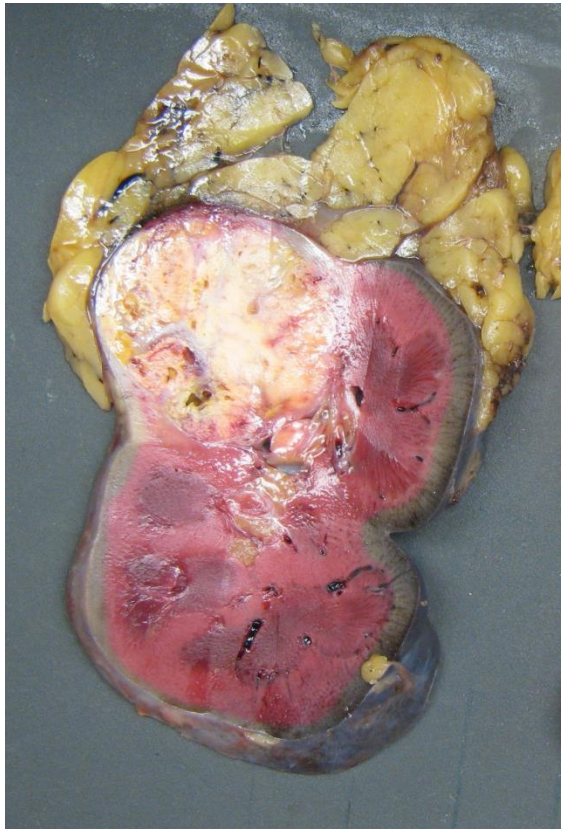
- Clear cell renal cell carcinoma
- Papillary renal cell carcinoma
- Chromophobe renal cell carcinoma
- Rare types: ex.: collecting duct carcinoma , acquired cystic disease-associated renal cell carcinoma….

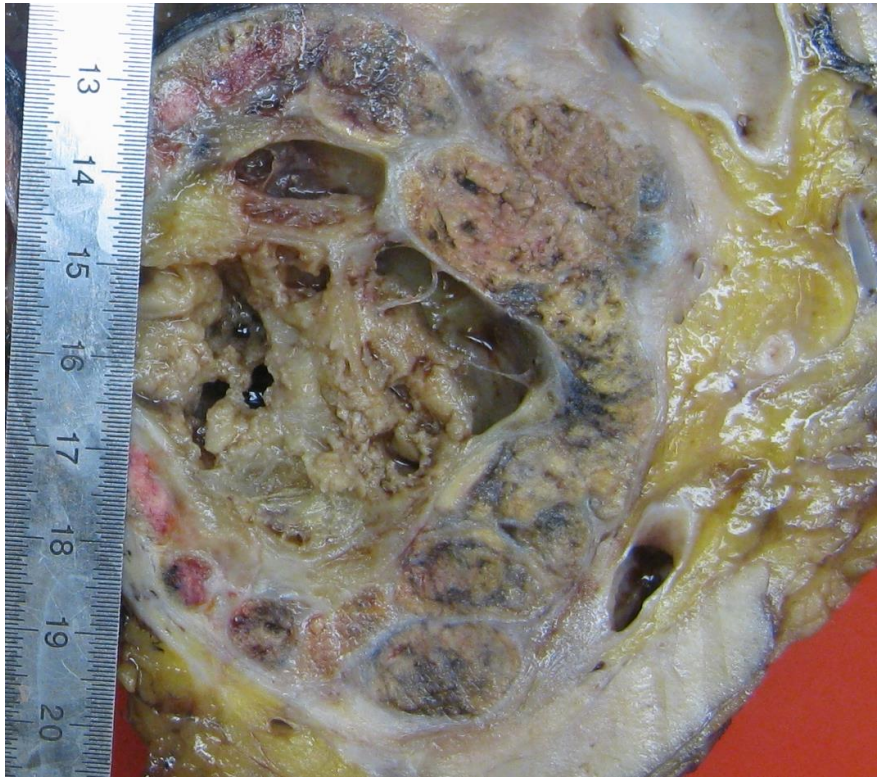
- Metastasis (rarely)

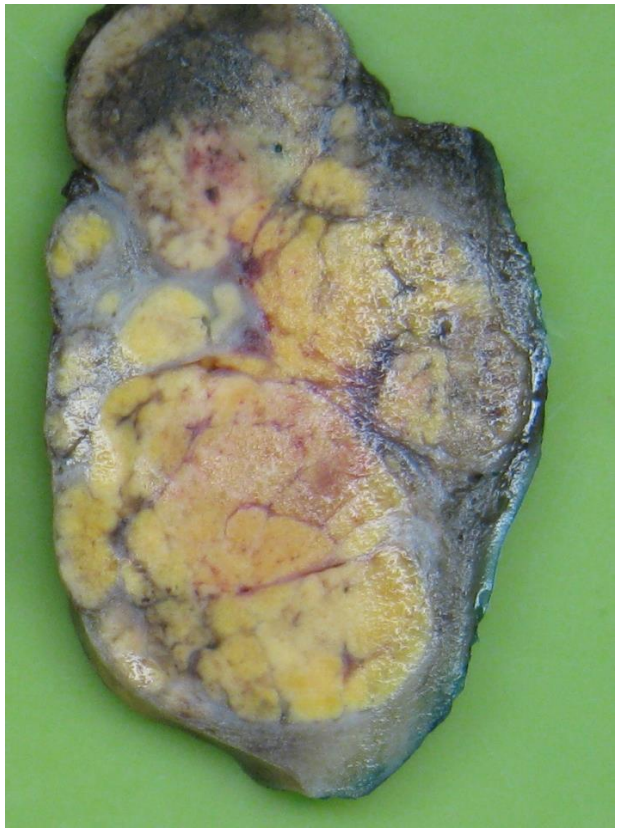
Clear cell renal cell carcinoma

- Most common malignant renal neoplasm
- Mainly solitary
- Expansive growth
- Yellowish color (former nomenclature: hypernephroma)
- Often shows cystic degeneration, hemorrhage
- Soft consistency
- Microscopically: clear cells (lipid and glycogen rich cytoplasm)
- Metastasis: most commonly hematogenous dissemination, direct tumor invasion to renal vein and vena cava
  -> lung, brain, bone, suprarenal gland, liver

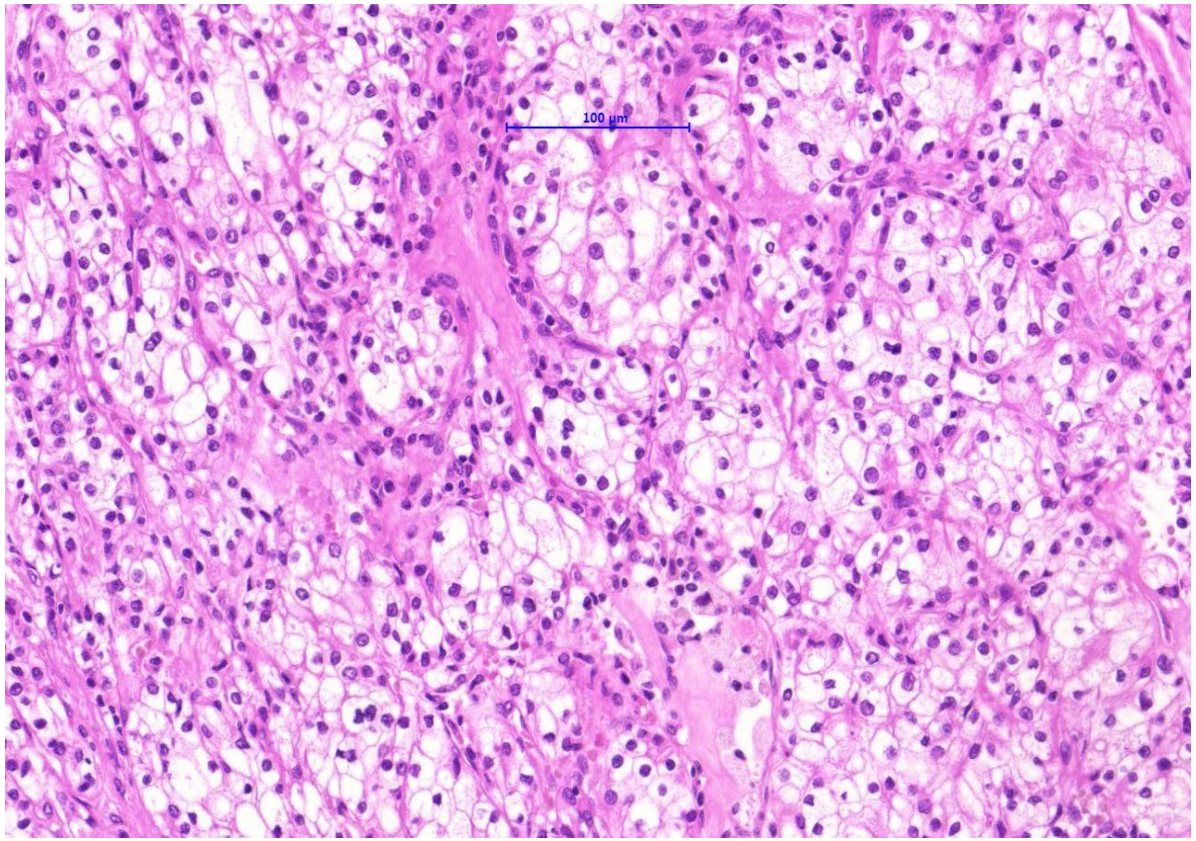
Clear cell renal cell carcinoma







Clear cell renal cell carcinoma



- Clusters of cells, lack of desmoplasia
- The cytoplasm is clear or slightly granular (glycogen and lipid rich)

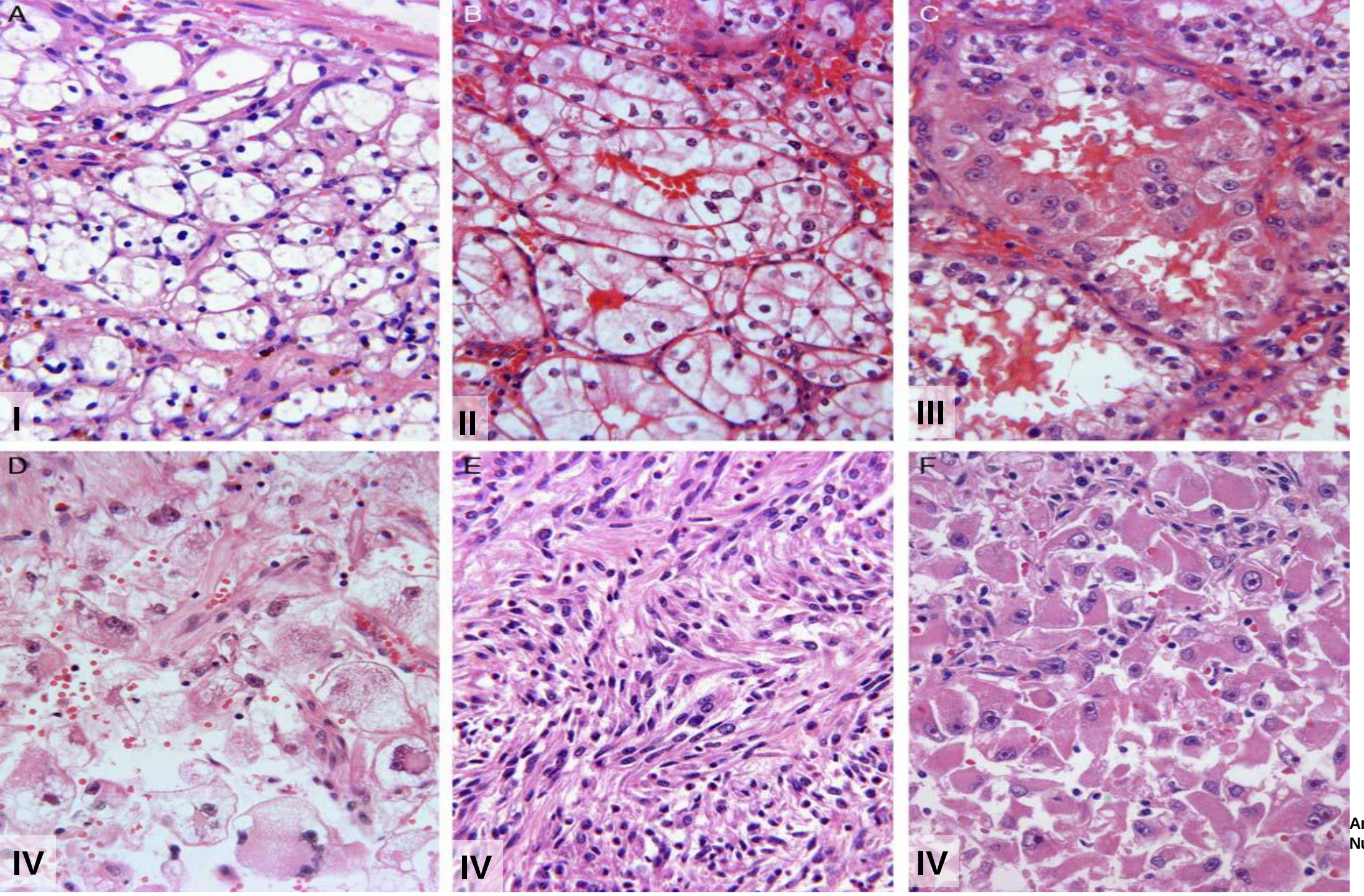
- GRADING: according to size of nucleoli!

Papillary renal cell cancer

- 10-20% of renal neoplasms in adulthood
- Often bilateral or multiplex
- Papillary structures have fibrovascular core
- 2 types
- Macroscopically: light yellowish color, hemorrhage, necrosis, cystic degeneration
- Microscopically: foamy macrophages, intracellular hemosiderin, psammoma bodies, hyaline globules sometimes present
- Greatest diameter is larger than 15 mm
  (below this size: papillary adenoma)

Chromophobe renal cell carcinoma

- 5-7% of renal neoplasms in adulthood
- Macroscopically brownish color
- Microscopically: perinuclear halo, abundant cytoplasm with reticular pattern
- Good prognosis



ISUP grade (clear cell RCC, papillary RCC)

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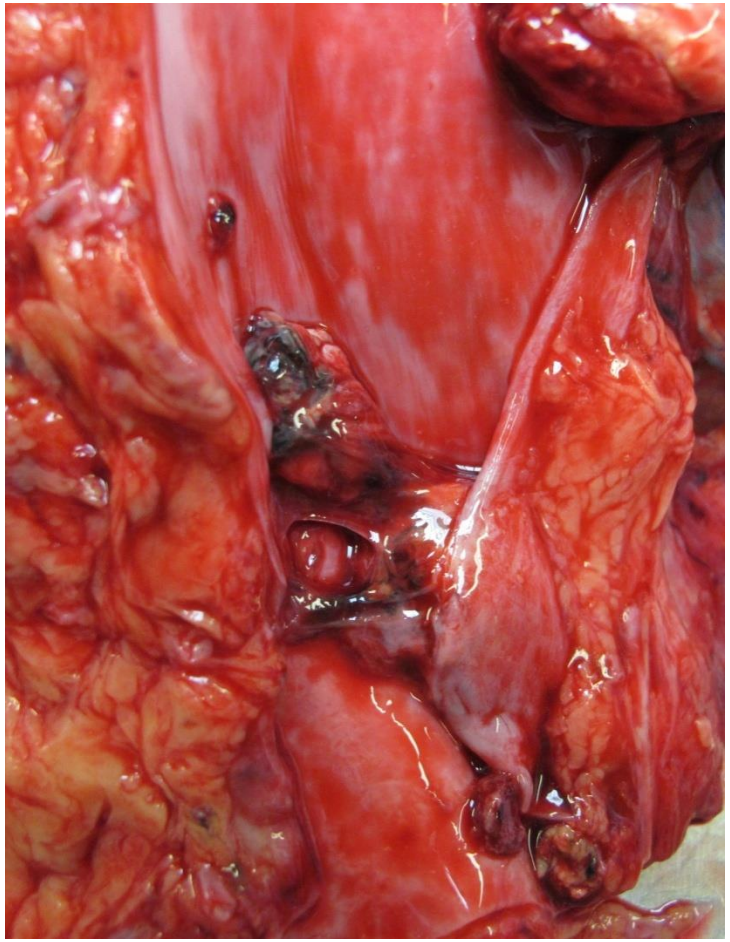
Renal Cancer- Staging

- Size
- Venous invasion
- Pelvic invasion
- Invasion of renal pelvis fat
- Invasion to perinephric tissues
- Invasion beyond the Gerota fascia

- Metastasis



Tumor thrombus in inferior vena cava