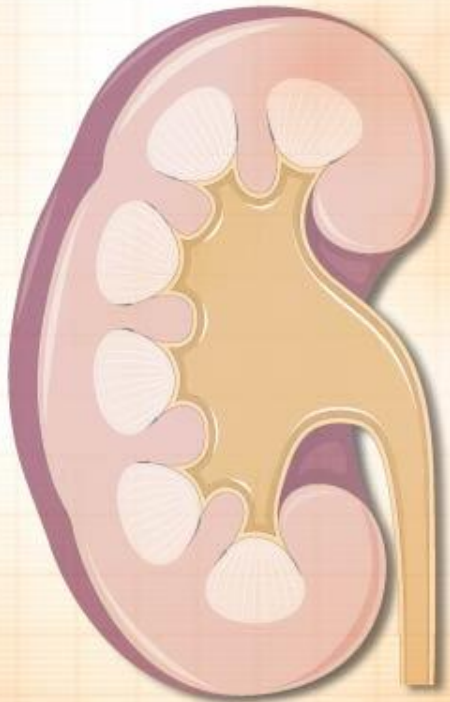


Interstitial Nephropathies. Urinary Tract Infections.



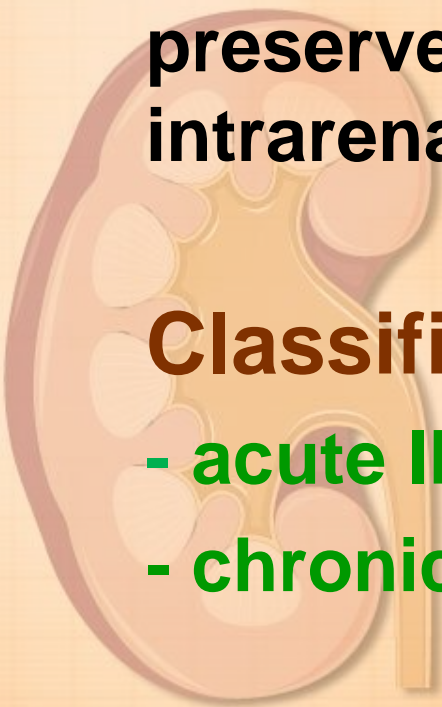
Tubulo-Interstitial Nephropathies

Definition

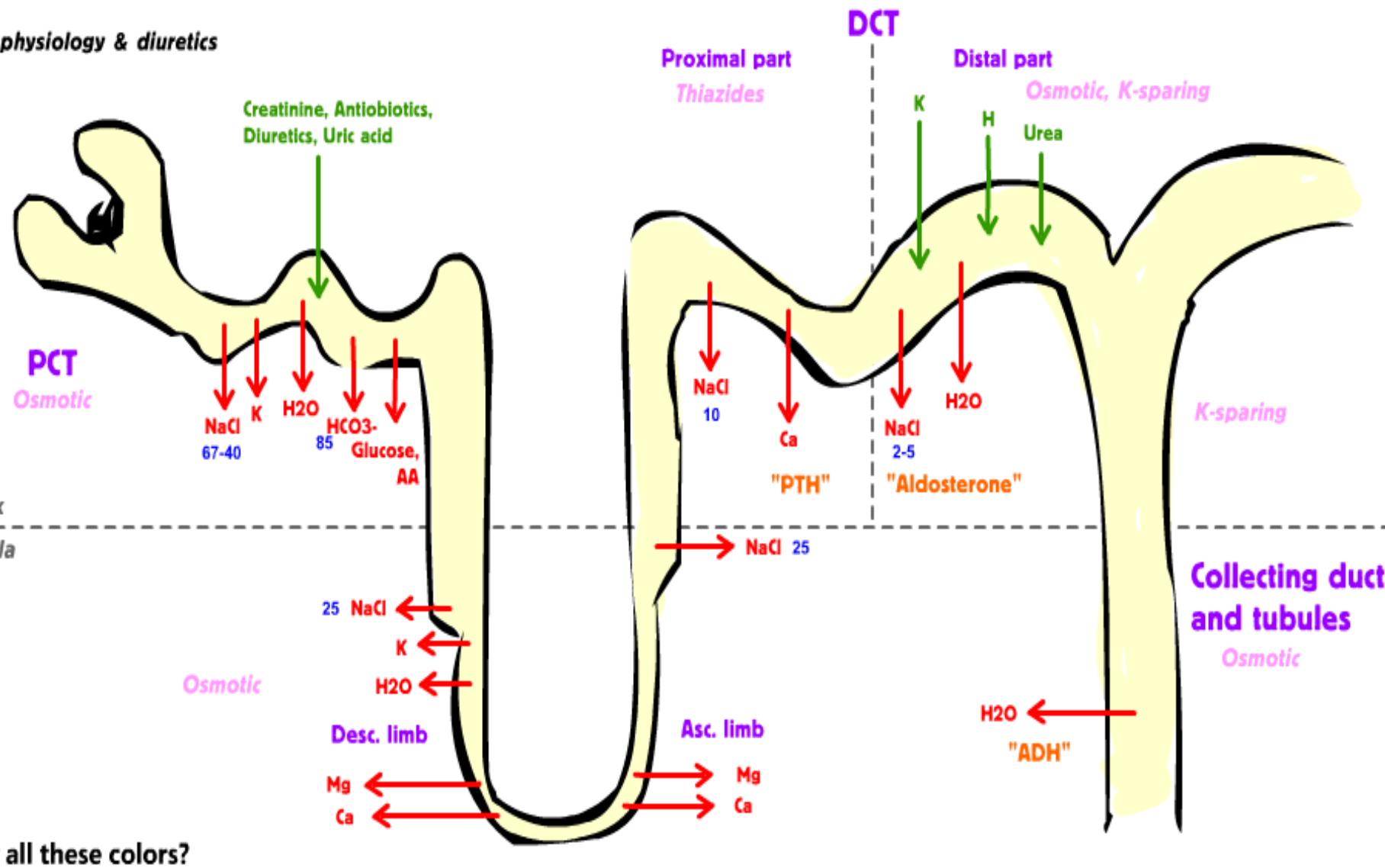
IN are renal disorders of variable etiology, in which the main **lesions are located in the renal interstitium** what contributes to **tubular injury later on**, however with preserved glomerular integrity and intrarenal vascularization.

Classification by evolution:

- acute IN
- chronic IN



Renal physiology & diuretics



Why all these colors?

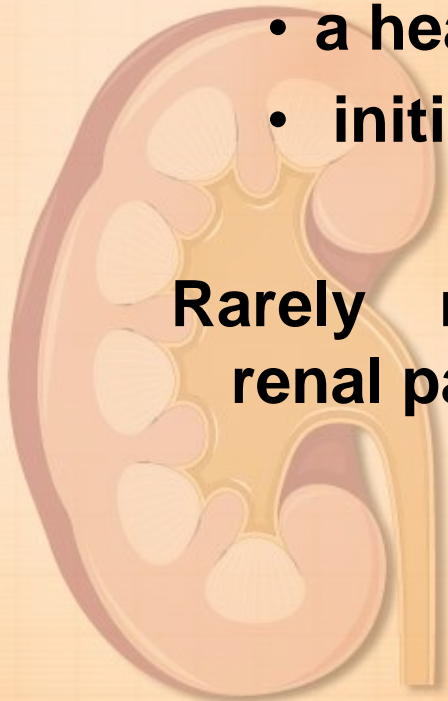
- Segment name in violet
- Diuretic name in pink
- Reabsorption in red
- Secretion in green
- Percentage in blue
- Hormone in orange

Acute Interstitial Nephropathies (AIN) - Definition

These are acute renal disorders, that usually occur in:

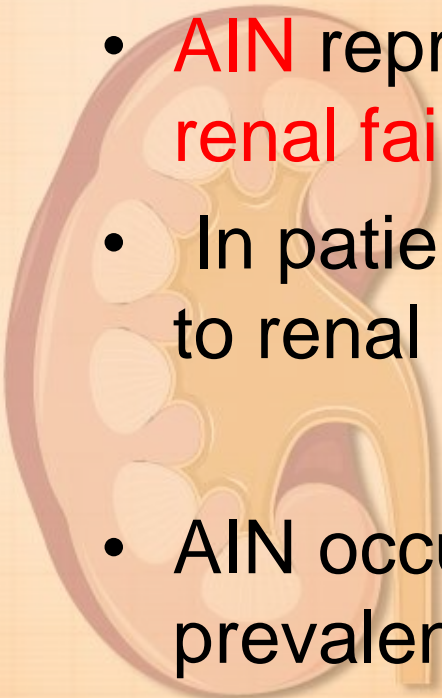
- **a healthy kidney**
- **initially involving the interstitium.**

Rarely may occur on preexisting injuries of the renal parenchyma (either glomerular or vascular)

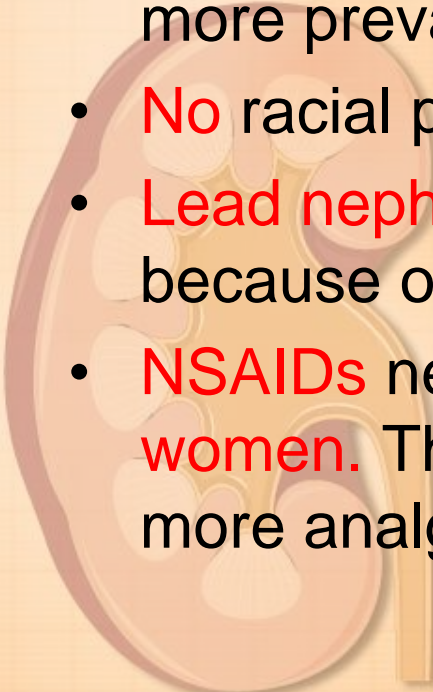


AIN Epidemiology

- **AIN incidence is increasing**, particularly due to exposure to a larger number of nephrotoxic agents (drugs, industrial toxic substances);
- **AIN represents one of the main causes of acute renal failure (ARF)**, usually being **reversible**;
- In patients with ARF of unknown cause, subject to renal biopsy, AIN rate reaches 15%;
- AIN occurs at any age, with a maximal prevalence in the 50–60 decade.

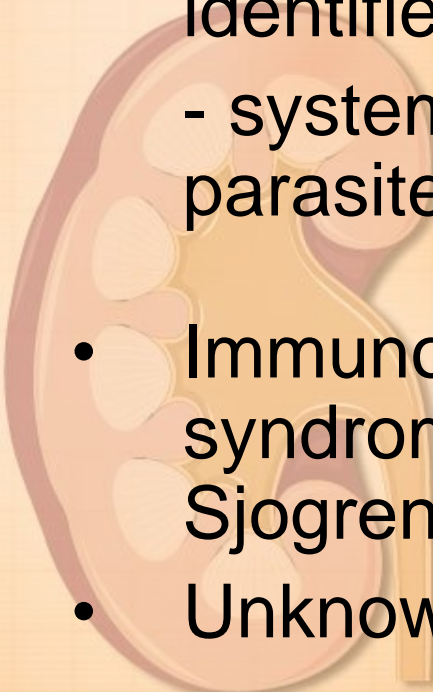


Epidemiology

- Primary TIN **constitute 10-15%** of all kidney diseases both in the United States and around the world.
 - In regions, such as the Balkans, where endemic nephropathy is common, interstitial diseases may be more prevalent.
 - **No** racial predilections.
 - **Lead nephropathy** may be **more common in black people** because of socioeconomic factors.
 - **NSAIDs** nephropathy is 5-6 times **more common in women**. This is generally attributed to women taking more analgesics than men.
- 

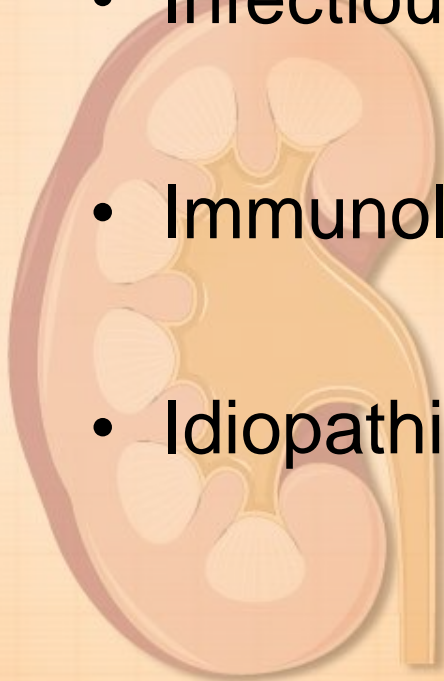
AIN etiology

- Drug hypersensitivity
- Infections
 - acute pyelonephritis (the infectious agent is identified in the renal interstitium)
 - systemic infection – bacterial, viral, parasite, yeasts
- Immunologic disorders (SLE, Goodpasture's syndrome, acute renal transplante rejection, Sjogren's syndrome, sarcoidosis)
- Unknown cause (idiopathic AIN)



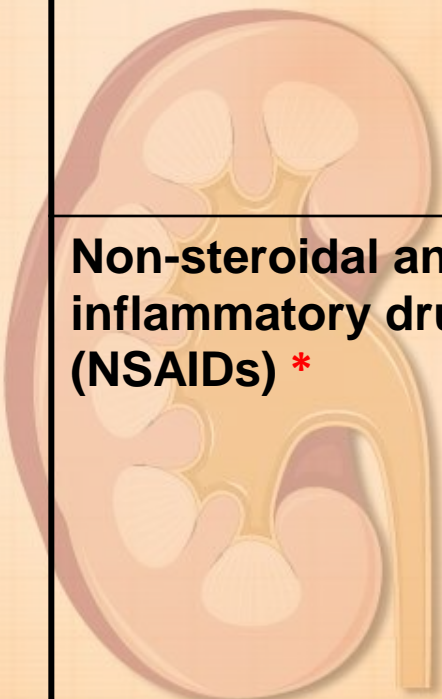
AIN etiologic types

- Drug-induced AIN
- Infectious AIN
- Immunologic AIN
- Idiopathic AIN

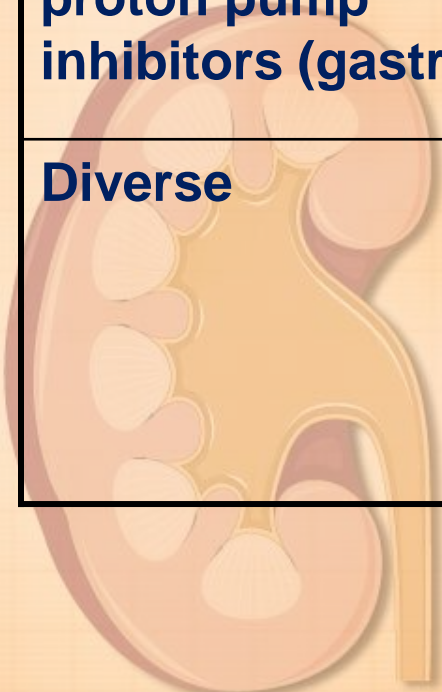


Drug-induced AIN

Drug class	Frequently used	Rarely used
Antibiotics and antimicrobial chemotherapy	Amoxicillin* Oxacillin Cotrimoxazole Cephalosporins* Isoniazid Rifampicin Ciprofloxacin	Penicillin Meticillin Carbenicillin Polymyxin B Vancomycin
Non-steroidal anti-inflammatory drugs (NSAIDs) *	Diclofenac Ibuprofen Ketoprofen Indomethacin Phenylbutazone Meloxicam Piroxicam	Naproxen Niflumic Acid Diflunisal Tolmetin



Drug-induced AIN



Diuretics*	Furosemide Indapamide Hydrochlorothiazide	Triamterene
H 2 blockers and proton pump inhibitors (gastric)	Ranitidine Famotidine Omeprazole Lansoprazole	Cimetidine
Diverse	Allopurinol Methyldopa Phenobarbital Azathioprine Carbamazepine Diltiazem	Captopril Clofibrate Fenofibrate Gold salts Warfarin Propranolol

AIN of other etiology

Disease category

Specific examples

Bacterial infections

Corynebacterium diphtheriae, legionella, staphylococci, streptococci, yersinia

Viral infections

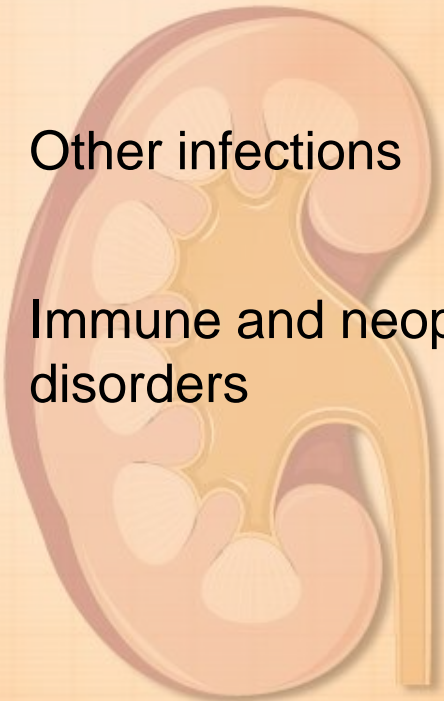
Cytomegalovirus, Epstein-Barr virus, hantaviruses, hepatitis C, herpes simplex virus, HIV, mumps, polyoma virus

Other infections

Leptospira, mycobacterium, mycoplasma, rickettsia, syphilis, toxoplasmosis

Immune and neoplastic disorders

Acute rejection of a renal transplant, glomerulonephritis, lymphoproliferative disorders, necrotizing vasculitis, plasma cell dyscrasias, systemic lupus erythematosus

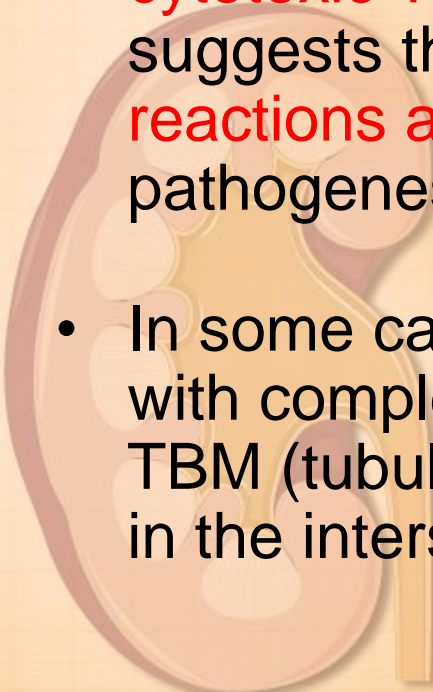


AIN pathogenesis

- **Immune**
 - **Following exposure to drugs (drug-induced AIN)**
 - **Within some immunologic disorders (immunologic AIN)**
 - **Within some systemic infections**
- **Infectious**
 - **acute bacterial pyelonephritis**

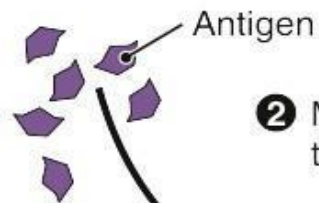


AIN pathogenesis

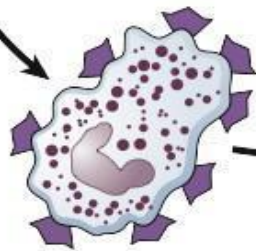
- The precise disease mechanism is unclear, but antigen-driven immunopathology is the key mechanism.
 - The presence of **helper-inducer and suppressor-cytotoxic T lymphocytes** in the inflammatory infiltrate suggests that **T-cell mediated hypersensitivity reactions and cytotoxic T-cell injury** are involved in pathogenesis of AIN.
 - In some cases, **humoral mechanisms** are involved with complement proteins, immunoglobulins, and anti-TBM (tubular basement membrane) antibodies found in the interstitium.
- 

TYPE 4 IMMUNE REACTION (DELAYED, CELLULAR HYPERSENSENSITIVITY)

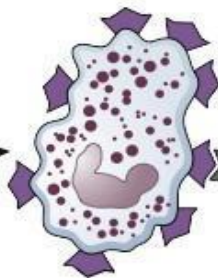
1 Foreign antigen enters body



2 Macrophage attaches to antigen



3 Macrophage presents antigen to T lymphocytes



T lymphocyte receptors

Returns to immune system



Memory T lymphocyte

Cytotoxic T cell

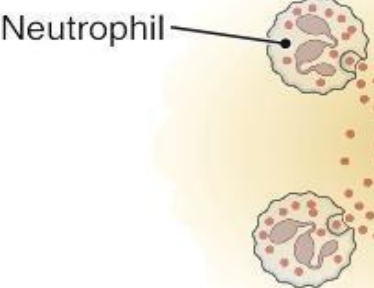


4 **Autoimmune reaction:** Cytotoxic T cell attaches to similar antigen in healthy tissue



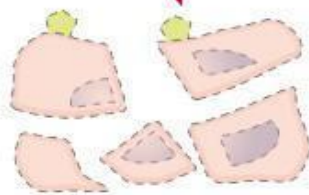
Normal antigen

Healthy tissue cell



Inflammation and neutralization of antigen

5 Tissue destruction



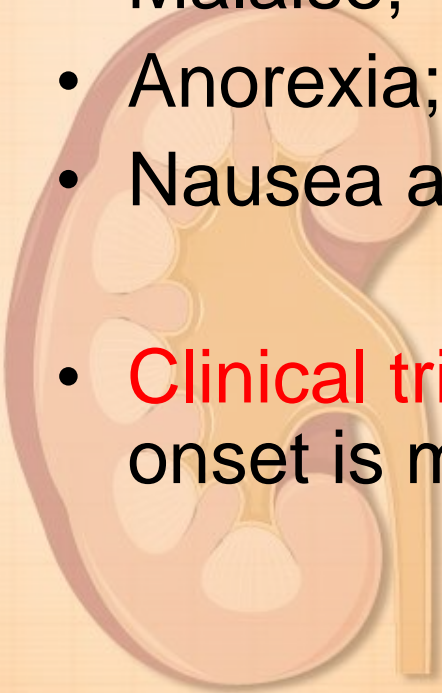
AIN diagnosis

- **Acute renal failure (ARF) with:**

- Oliguria or normal diuresis;
- Malaise;
- Anorexia;
- Nausea and vomiting

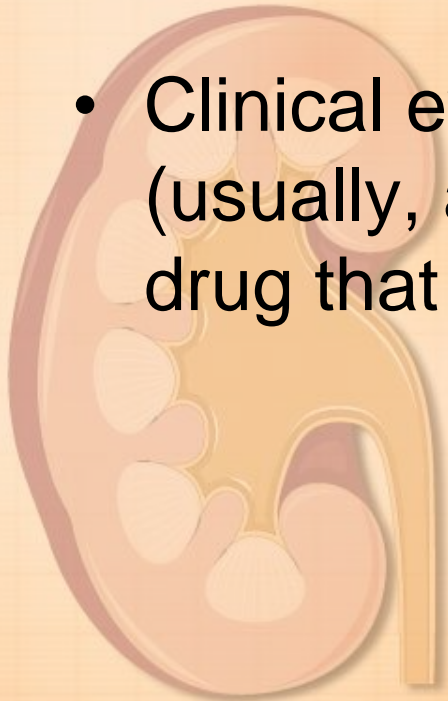
with acute or
subacute onset

- **Clinical triad:** fever, rash and arthralgia with acute onset is met in 1/3 of drug-induced AIN;



AIN diagnosis

- *Eventually, bilateral low back pain* (renal capsule distention);
- Clinical evocative context for **drug induced AIN** (usually, after recently taking for **3 to 21 days** a drug that has been shown to induce AIN).



AIN diagnosis

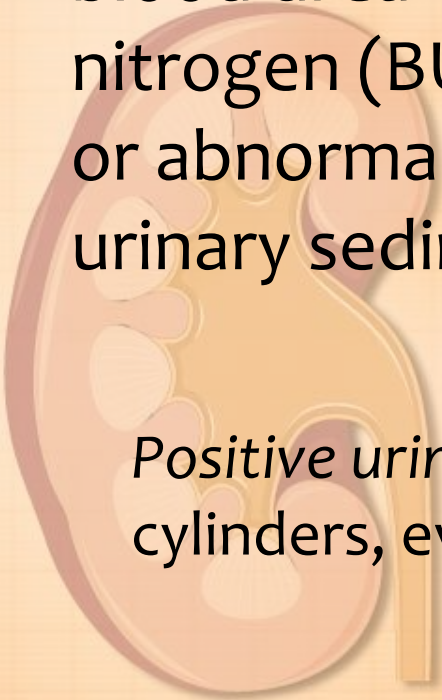
Asymptomatic elevation in creatinine or blood urea nitrogen (BUN) or abnormal urinary sediment.

Clinical presentation variability



Generalized hypersensitivity syndrome with fever, rash, eosinophilia, and oliguric renal failure.

Positive urinary sediment: leukocyturia, leukocyte cylinders, eventually bacteriuria (in infectious AINs)



AIN diagnosis

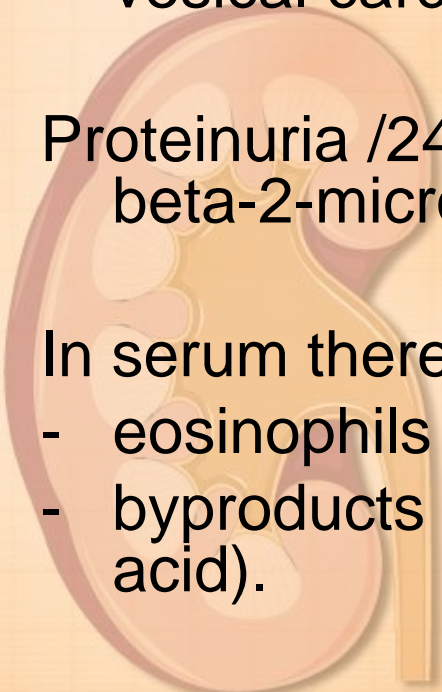
Urinalysis examination shows:

- leukocyturia associated with leukocyte cylinders
- hematuria inferior to leukocyturia,
- mild to moderate proteinuria (tubular),
- eosinophiluria (non-specific, may be seen in prostatitis, vesical carcinoma as well).

Proteinuria /24 hours does not exceed 1g, with predominating beta-2-microglobulin (tubular injury marker).

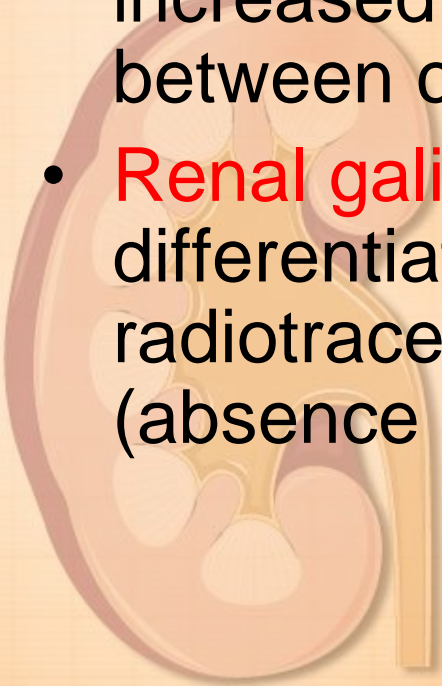
In serum there is an elevation of:

- eosinophils count, and IgE
- byproducts of nitrogen retention (BUN, creatinine and uric acid).

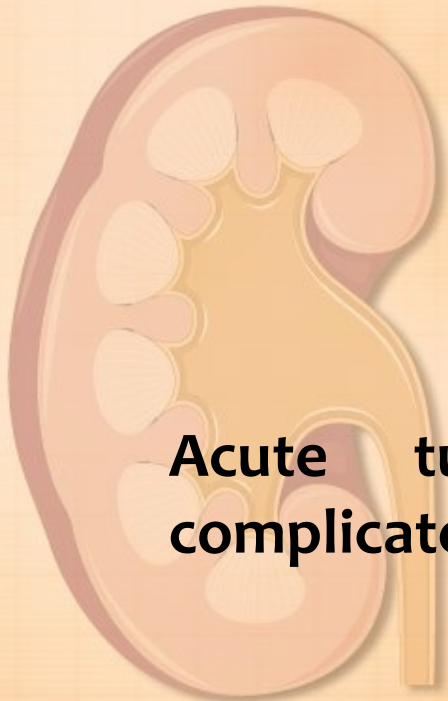


AIN diagnosis

- **Renal ultrasound** exam does not show any specific for AIN imagistic data, however it allows to rule out the obstructive causes of ARI.
- It shows **normal sized or enlarged kidneys**, with increased echogenicity, and unclear boundaries between cortical and medullar layers
- **Renal galium 67 scintigram** allows for the differentiation of AIN (the kidneys capture the radiotracer) from acute tubular necrosis (absence of galium 67 capture at renal level).



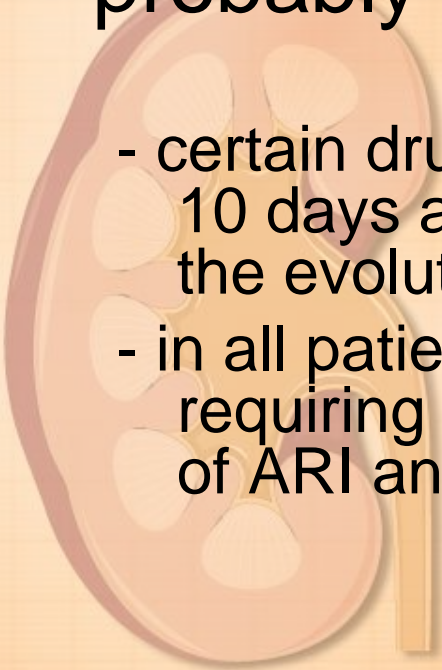
Renal ultrasound: AIN



**Acute tubulo-interstitial nephritis (drug induced)
complicated with acute renal failure**

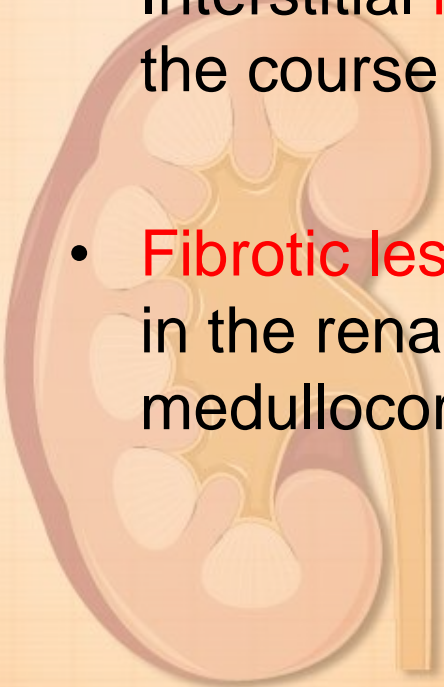
Renal biopsy in AIN

- Considered to be the „golden standard” for AIN diagnosis, however rarely applied
- Indications for renal biopsy in ARF probably caused by AIN :
 - certain drug-induced AIN with mild ARF in which after 10 days after discontinuation of the incriminated drug, the evolution is unfavorable (ARI worsening);
 - in all patients with drug-induced AIN and ARF requiring acute hemodialysis, to rule out other causes of ARI and assess the long-term evolution.



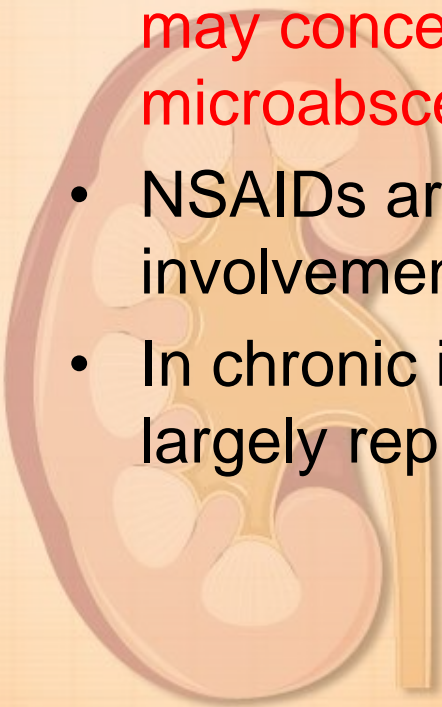
AIN Pathology

- The hallmark of AIN is **the infiltration of inflammatory cells within the renal interstitium with** associated edema, sparing the glomeruli and blood vessels.
- Interstitial **fibrosis** is **initially sparse**, but develops later in the course of the illness.
- **Fibrotic lesions** may be diffuse or patchy, beginning deep in the renal cortex, most prominently at the medullocortical junction.



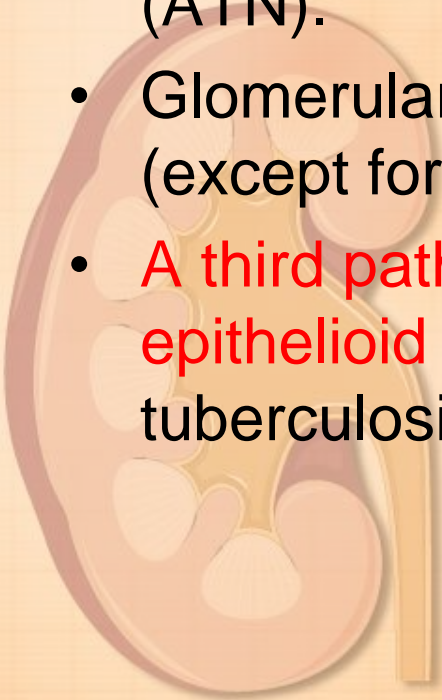
AIN Pathology

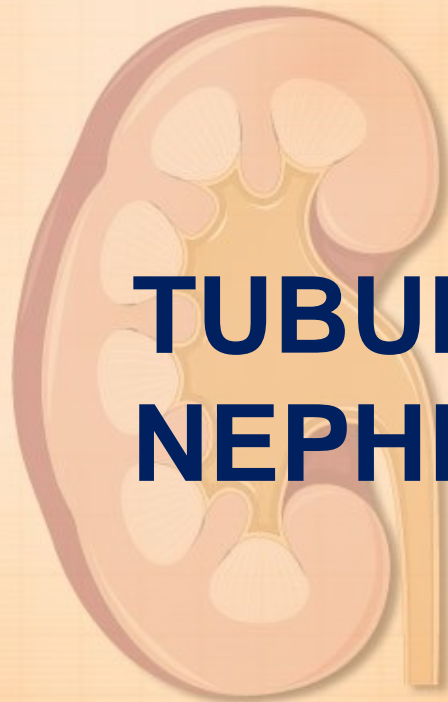
- The **inflammatory infiltrate** is typically composed of **mononuclear cells and T lymphocytes**, with a variable number of plasma cells and eosinophils.
- **Eosinophils** may be totally **absent** from the infiltrate **or may concentrate in small foci, forming eosinophilic microabscesses.**
- NSAIDs are commonly associated with glomerular involvement producing a minimal change disease.
- In chronic interstitial nephritis, the cellular infiltrate is largely replaced by interstitial fibrosis.



AIN Pathology

- Peritubular infiltration and occasional invasion of lymphocytes beneath the tubular basement membrane may occur with mild to extensive tubular damage, which may be difficult to distinguish from acute tubular necrosis (ATN).
- Glomerular and renal vascular injuries are absent (except for collagenoses and vasculitides).
- A third pathologic category is granuloma formation with epithelioid giant cells usually found in AIN secondary to tuberculosis, sarcoidosis, or Wegener's granulomatosis.

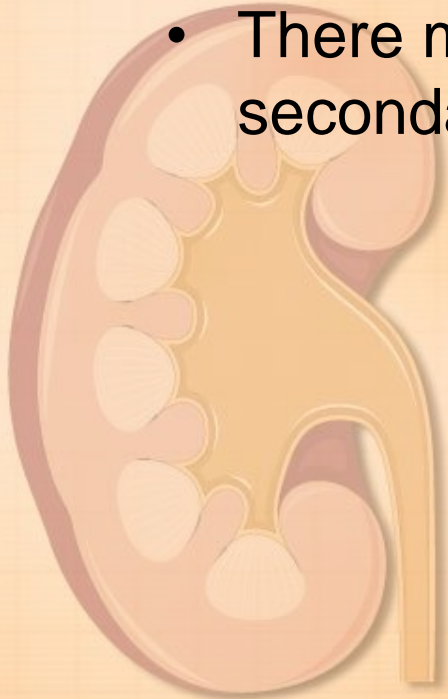




TUBULO-INTERSTITIAL NEPHRITIS

Tubulo-interstitial nephritis

- Inflammatory tubulo-interstitial condition, characterized by disorder of the concentration function and sometimes, kidney filtration function.
- There may be glomerular changes, however of a secondary character (as a rule).



TIN. Causes

1. Environmental factors

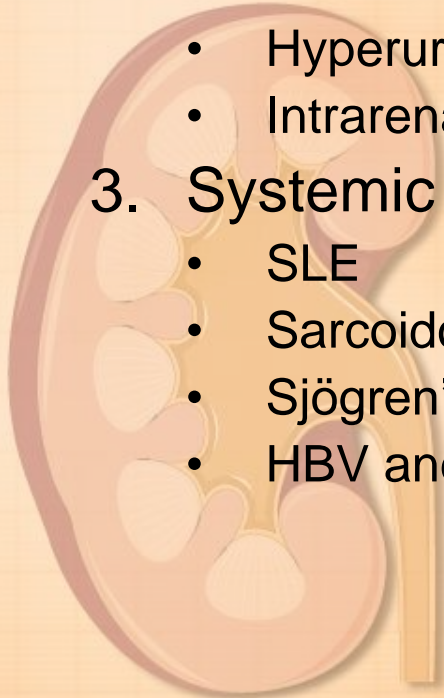
- Cadmium
- Lead
- Ionizing radiation

2. Metabolic disorders

- Hyperuricemia
- Intrarenal artery embolism with cholesterol crystals

3. Systemic conditions

- SLE
- Sarcoidosis
- Sjögren's syndrome
- HBV and HCV infection



TIN. Causes

4. Infections and invasions

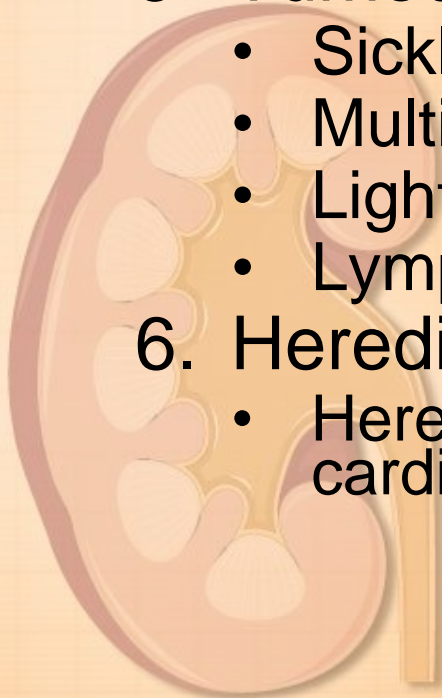
- bacterial
- viral
- parasitic

5. Tumours/hematologic disorders

- Sickle cell anemia
- Multiple myeloma
- Light chain disease
- Lymphoproliferative conditions

6. Hereditary

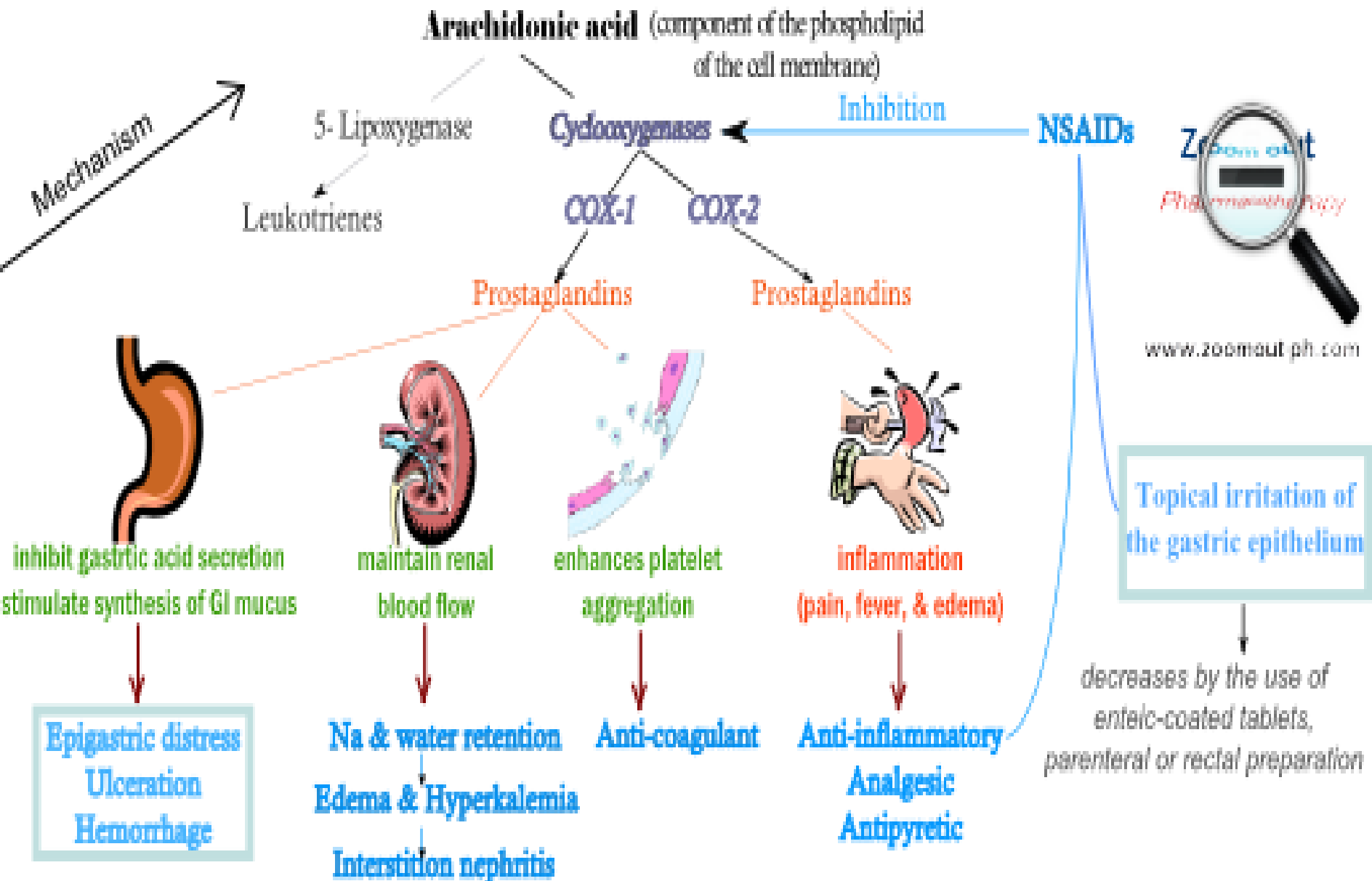
- Hereditary tubulo-interstitial nephritis with cardiomegaly



TIN. Pathogenesis

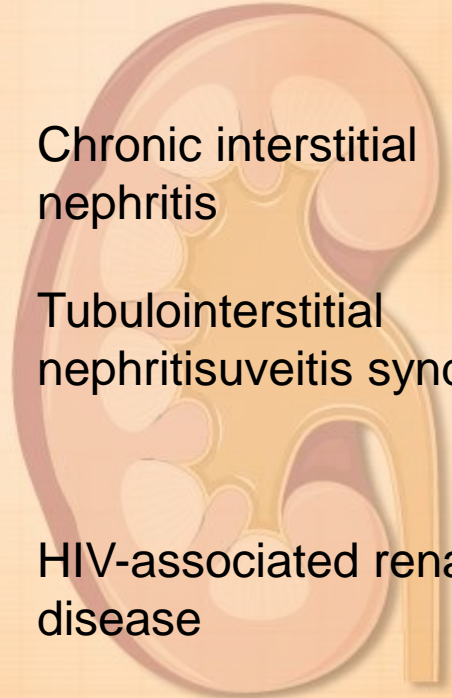
- The vulnerability of tubulo-interstitial renal structures is caused mainly by the modest blood alimentation of this area, which is associated with a higher risk for ischemia and subsequent development of fibrosis.
- The main mechanism in case of renal disorder induced by NSAIDs is the insufficiency of local renal vaso-dilatator system (decrease of renal prostaglandins, due to their inhibition)
- In the development of analgesic nephritis an important role belongs to the total dose of the preparation and the duration of use, which sometimes may exceed 20-30 years.
- The main molecules: Prostaglandins, TGF beta

Non-steroidal Anti-inflammatory Drugs - Mechanism of Action



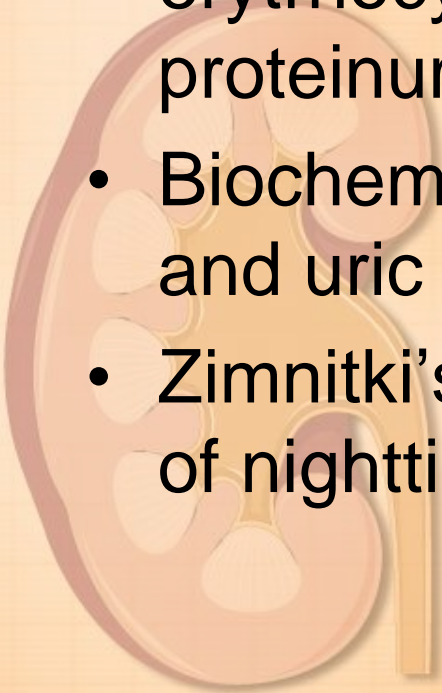
TIN. Diagnosis. Some Clinical Syndromes Manifesting as Interstitial Nephritis

<i>Syndrome</i>	<i>Typical features</i>
Analgesic-induced AIN	History of chronic pain or aspirin use; associated with epigastric symptoms, anemia, sterile pyuria
Toxin-induced AIN (lead)	Progressive renal failure associated with lead exposure, hypertension, gout, and proteinuria
Sarcoidosis and AIN	Granulomatous interstitial nephritis associated with hypercalcemia and pulmonary involvement
Chronic interstitial nephritis	Heavy metal exposure or other causes; mild proteinuria, glucosuria with normal serum glucose
Tubulointerstitial nephritisuveitis syndrome	Diffuse eosinophilic nephritis with bone marrow and lymphoid granulomas seen in pubertal females with constitutional symptoms and uveitis
HIV-associated renal disease	AIDS nephropathy, drug-induced AIN, proteinuria, other renal disorders



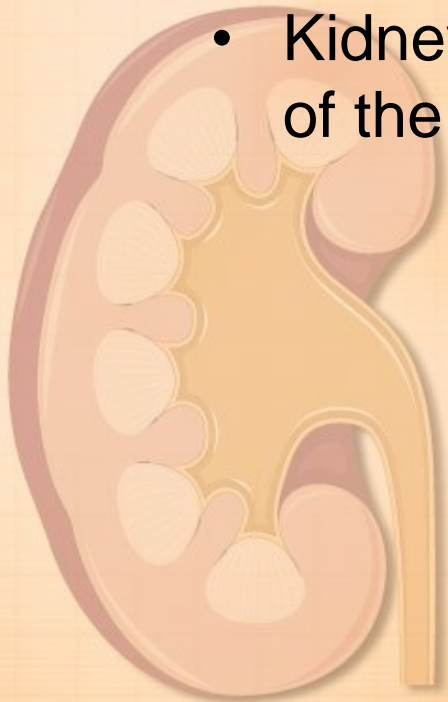
TIN. Diagnosis

- Complete blood count: anemia, in case of drug-induced cause – with eosinophilia.
- Urinalysis: hyposthenuria, basic reaction, erythrocyturia, sterile leukocyturia, tubular proteinuria.
- Biochemistry: elevated creatinine, potassium, and uric acid
- Zimnitki's test: hyposthenuria, predomination of nighttime versus daytime diuresis.

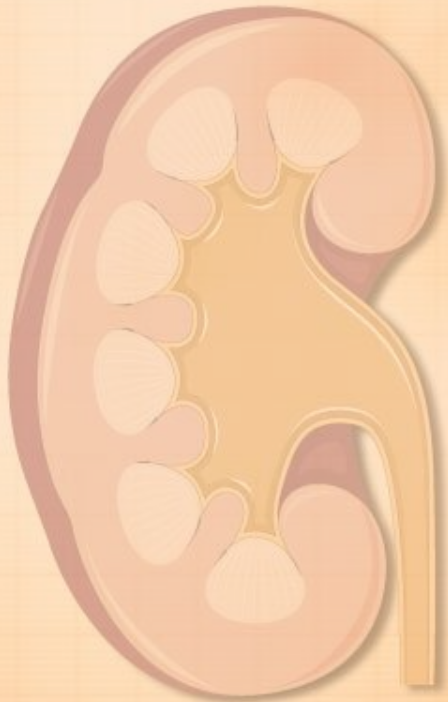


TIN. Diagnosis

- Kidney USG : enlarged swollen kidneys (in acute phase) or shrunken, with uneven contour, cysts and calcinates (in chronic TINs)
- Kidney CT: shows the size of the kidneys, size of the cysts, and thickness of the cortical layer.

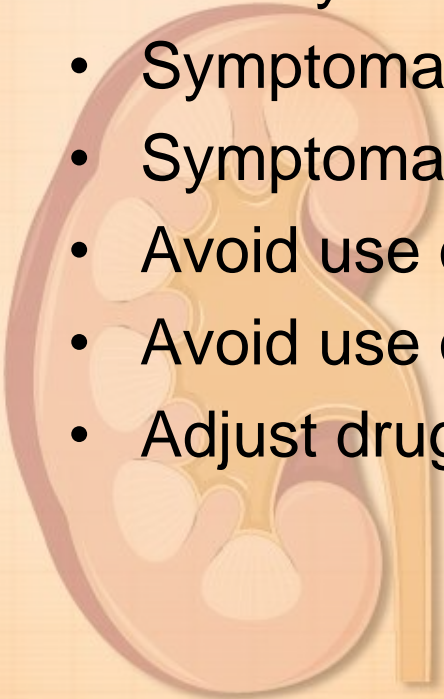


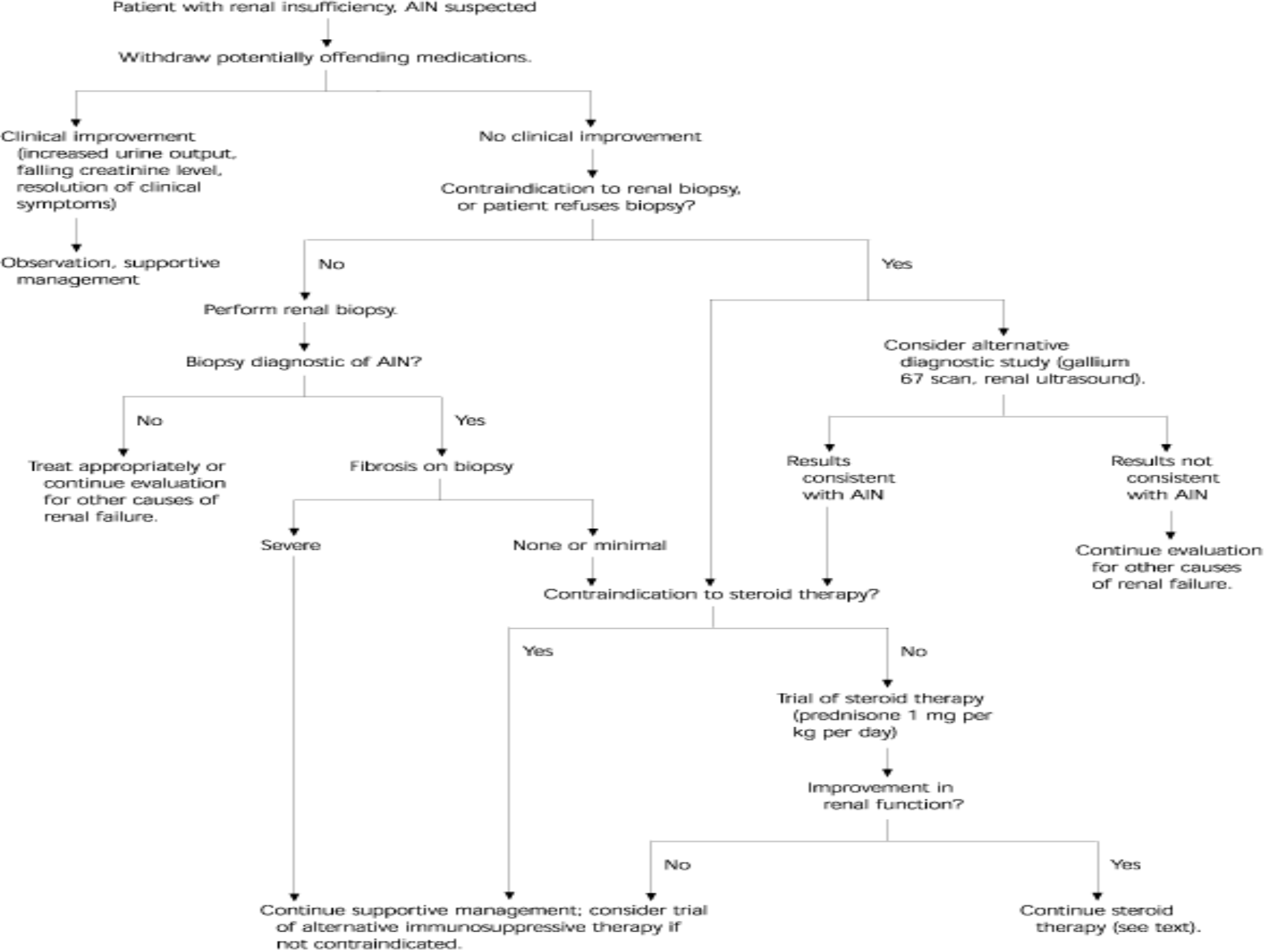
The treatment of TIN is mainly etiologic



Supportive Care Measures AIN and TIN

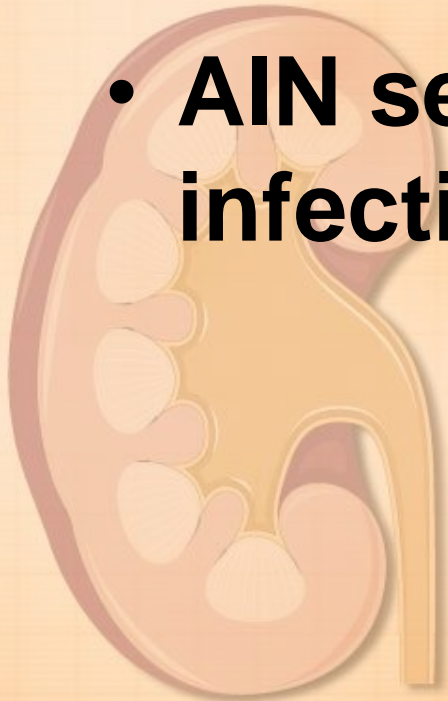
- Fluid and electrolyte management
- Maintain adequate hydration
- Avoid volume depletion or overload
- Identify and correct electrolyte abnormalities
- Symptomatic relief for fever and systemic symptoms
- Symptomatic relief for rash
- Avoid use of nephrotoxic drugs
- Avoid use of drugs that impair renal blood flow
- Adjust drug dosages for existing level of renal function

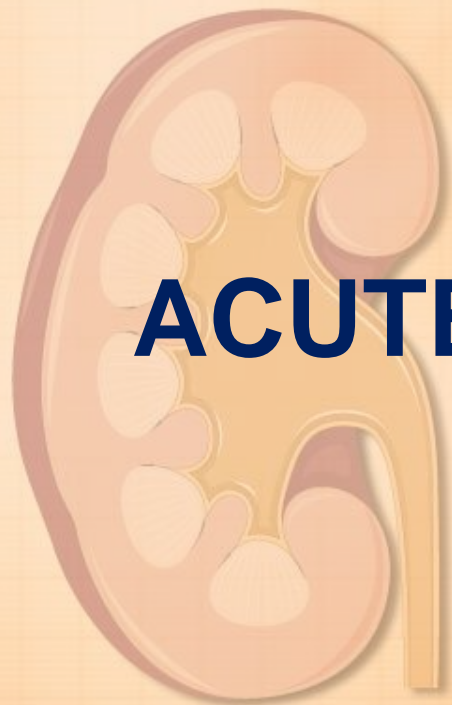




Infectious AIN

- **Acute pyelonephritis (APN)**
- **AIN secondary to a systemic infection**

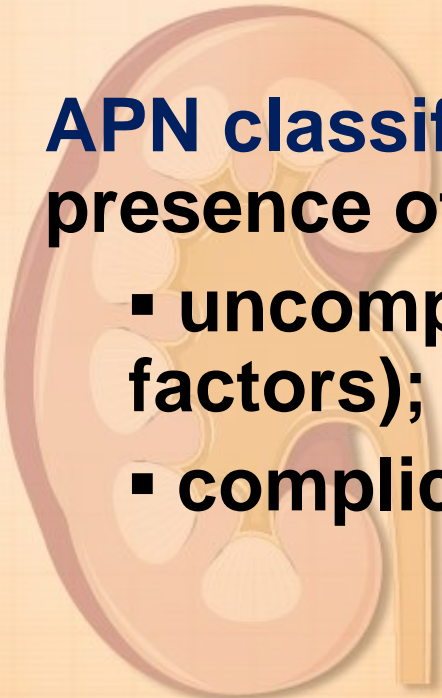




ACUTE PYELONEPHRITIS

Acute pyelonephritis (APN)

- **Definition:** acute nephropathy characterized by an infection of the interstitial tissue and renal pelvis.
- **APN classification** depending on the presence of favoring factors:
 - uncomplicated APN (without any favoring factors);
 - complicated APN – with favoring factors



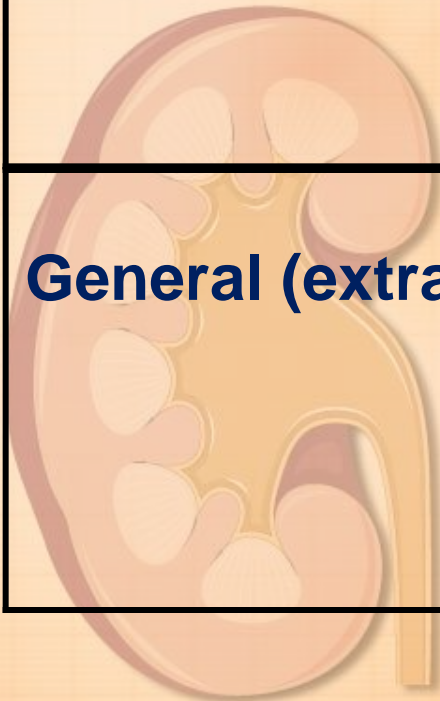
Favoring factors for UTIs (1)

Local (reno-urinary)

- renal and vesical lithiasis
- vesical-ureteral reflux, instrumental maneuvers on the urinary tract (urethral catheterization, endoscopic examinations)
- supra/subvesical obstruction
- intra-renal congenital (polycystic kidney) or acquired (interstitial nephropathies, papillary necrosis) anomalies

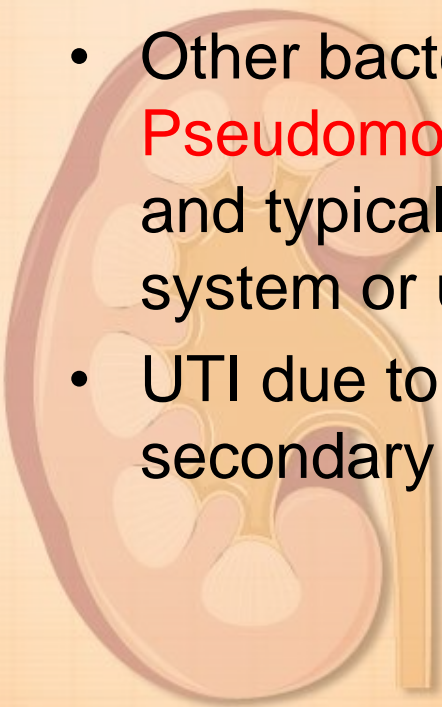
General (extra-urinary)

- diabetes mellitus
- pregnancy
- immune suppression (neoplasm, chronic kidney disease)
- female sex
- extreme ages (children/ elderly).



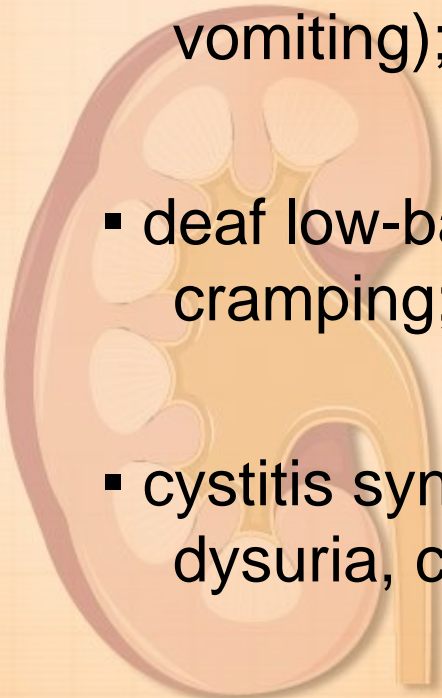
Causes

- **E.coli** is the cause of 80–85% of urinary tract infections.
- **Staphylococcus saprophyticus** being the cause in 5–10%.
- Rarely they may be due to viral or fungal infections.
- Other bacterial causes include: **Klebsiella, Proteus, Pseudomonas and Enterobacter**. These are uncommon and typically related to abnormalities of the urinary system or urinary catheterisation.
- UTI due to **Staphylococcus aureus** typically occur secondary to blood-borne infections.



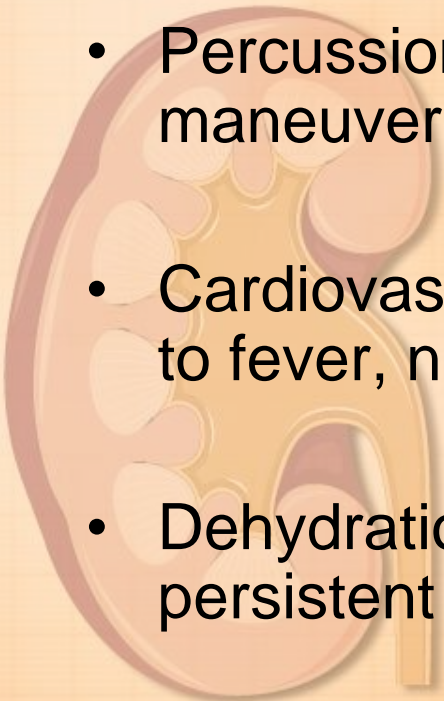
APN symptoms

- sudden onset within hours to 1-2 days;
- infectious syndrome (fever, chills, sweating, headache, myalgia, arthralgia, dizziness, nausea, vomiting);
- deep low-back pain (uni- or bilateral) or, randomly, cramping;
- cystitis syndrome (burning at urination, pollakiuria, dysuria, cloudy urine) ;



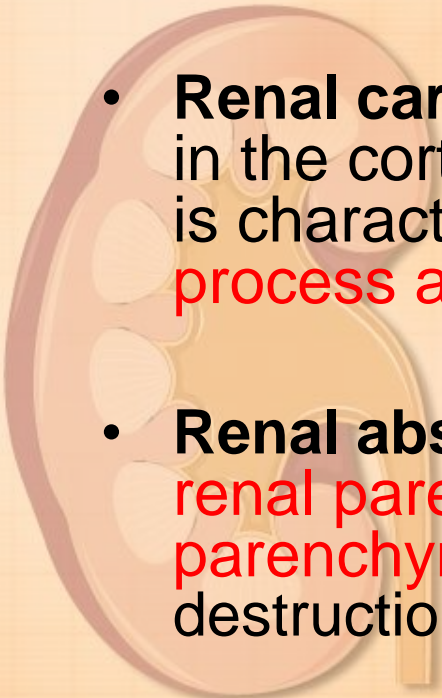
Physical exam in APN

- At palpation:
 - lumbar sensitivity,
 - painful ureteral points,
 - painful costo-muscular and costo-vertebral points;
- Percussion of the lumbar area: positive Giordano maneuver;
- Cardiovascular symptoms: tachicardia corresponding to fever, normal either slightly decreased BP;
- Dehydration signs (induced by fever): dry tongue, persistent skin fold.



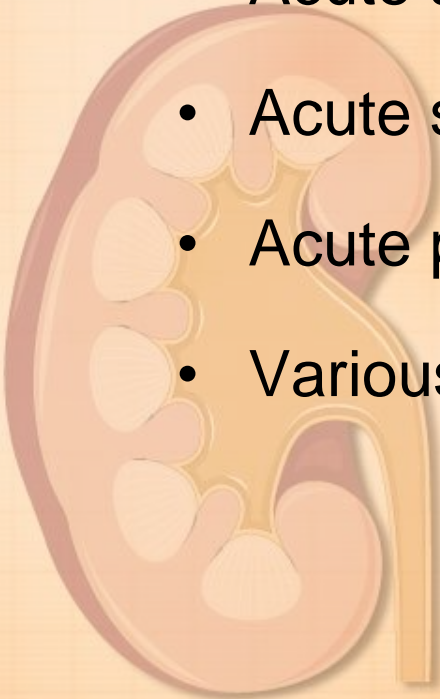
APN types

- **Serous**
- **Aposthematous** – an acute purulent process associated with formation of **multiple pustules (aposthemas)**, **particularly in cortex**
- **Renal carbuncle** – the inflammatory process develops in the cortical layer of the kidney **in a limited area** and is characterized by **a combination of ischemic, necrotic process and pus.**
- **Renal abscess** – occurs in **severe inflammation of renal parenchyma due to melting of suppurative parenchyma**, the merging of aposthemas, either destruction of a renal carbuncle.



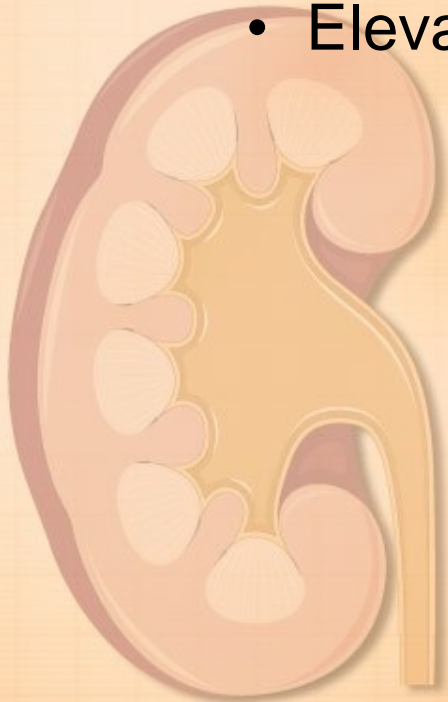
APN. Differentials

- Acute pancreatitis
- Acute cholecystitis
- Acute appendicitis
- Acute salpingitis
- Acute prostatitis
- Various acute infections – in the elderly



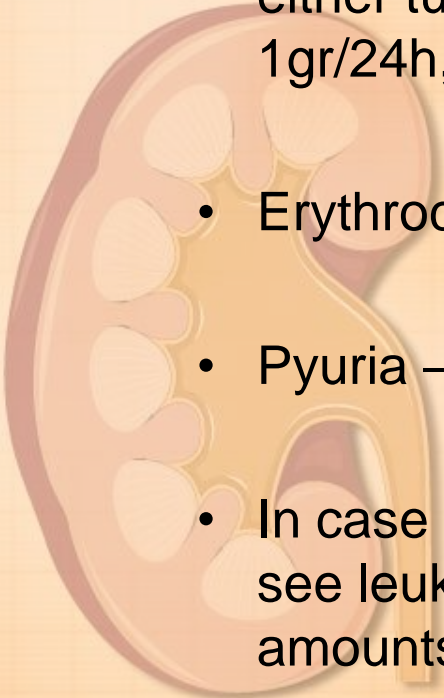
APN. Diagnosis

- Complete blood count
 - Leukocytosis with left shift in white blood cell counts
 - Elevated ESR

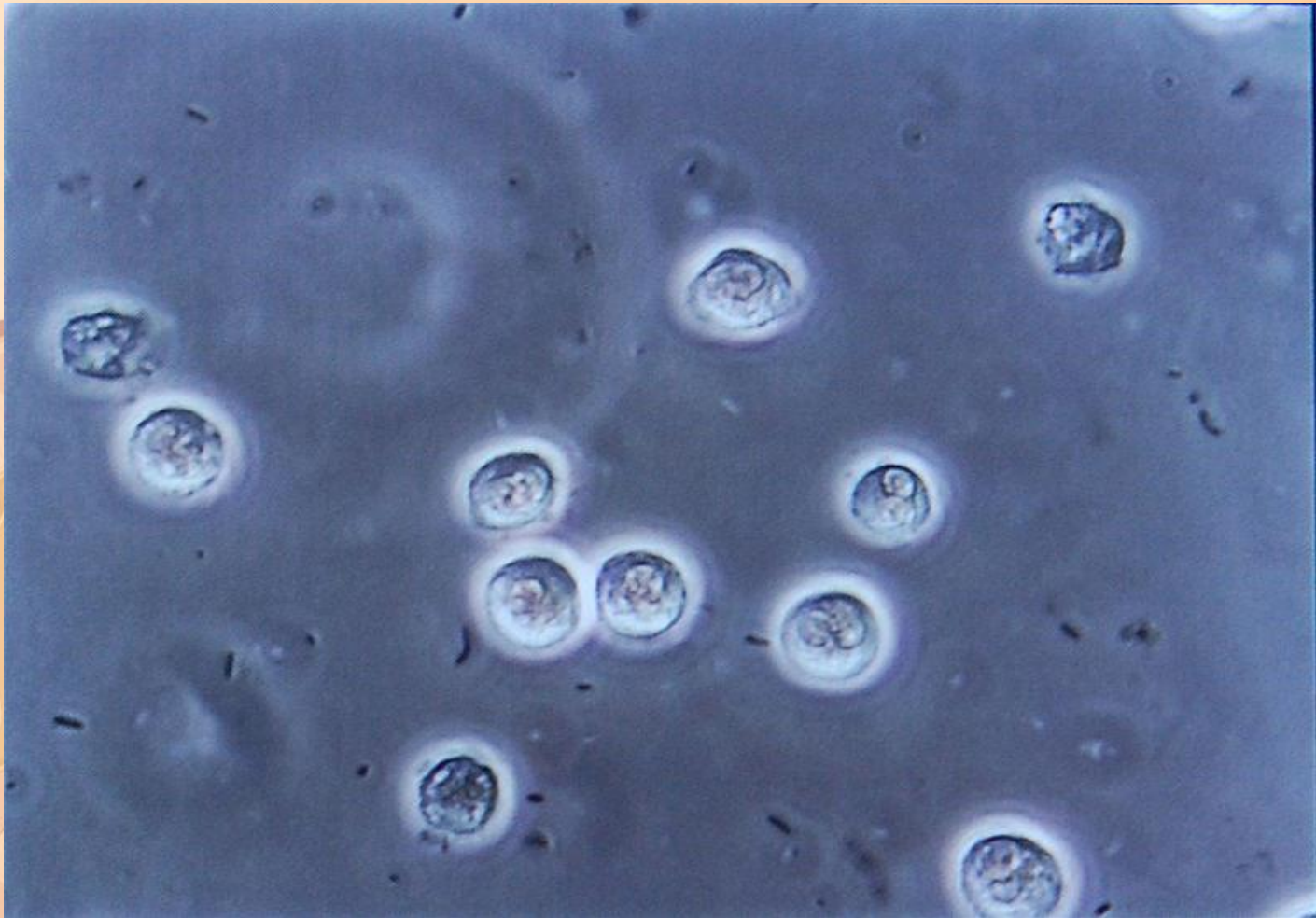


APN. Diagnosis

- Urinalysis :
 - Leukocyturia – more than 6 in the v/f
 - Proteinuria – usually false, due to degradation of leucocytes, either tubular, cause by tubulopathy; does not exceed 1gr/24h, more frequently varying from 0.033 up to 1.0.
 - Erythrocyturia – in obstructive uropathies.
 - Pyuria – leukocyturia + bacteriuria
 - In case of urine contamination with genital discharge one can see leukocytes in groups, flat epithelium and mucus in large amounts.

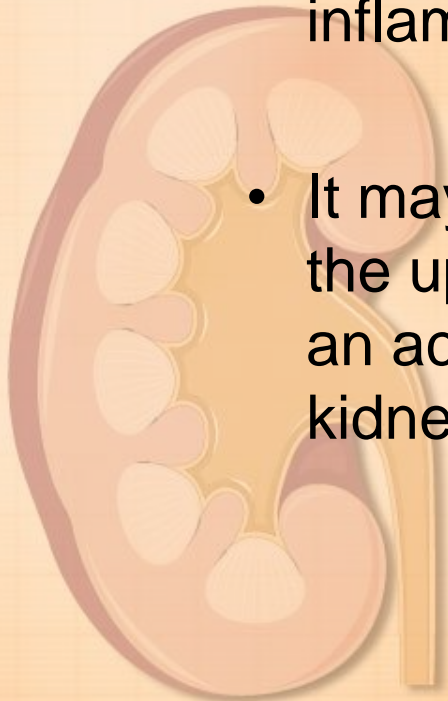


Pyuria



APN. Diagnosis

- Biochemical blood assessment:
 - Azotemia (elevated blood urea nitrogen, creatinine, uric acid) – is not a predictive sign of renal failure because of the localized character of inflammation.
 - It may be significant in case of total obstruction of the upper urinary tract with a stone or in case of an acute pathologic process in the contralateral kidney.

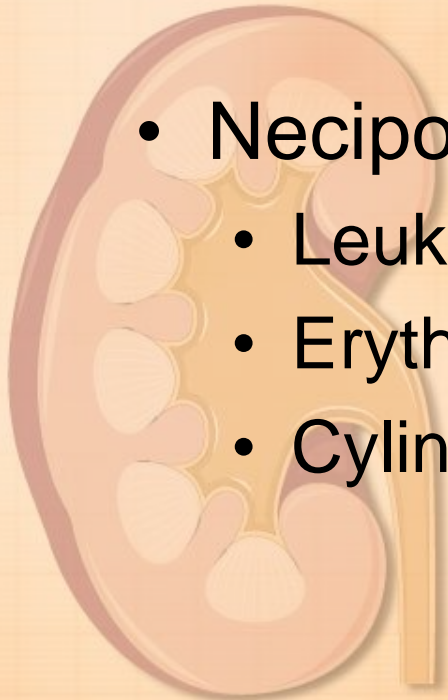


APN. Diagnosis

- Urine culture – shows growth of bacterial colonies, however it may be sterile when on antibiotic therapy.

- Neciporenco's test:

- Leukocytes – up to 4000 per ml of urine
- Erythrocytes – up to 2000 per ml of urine
- Cylinders – up to 20 per ml of urine

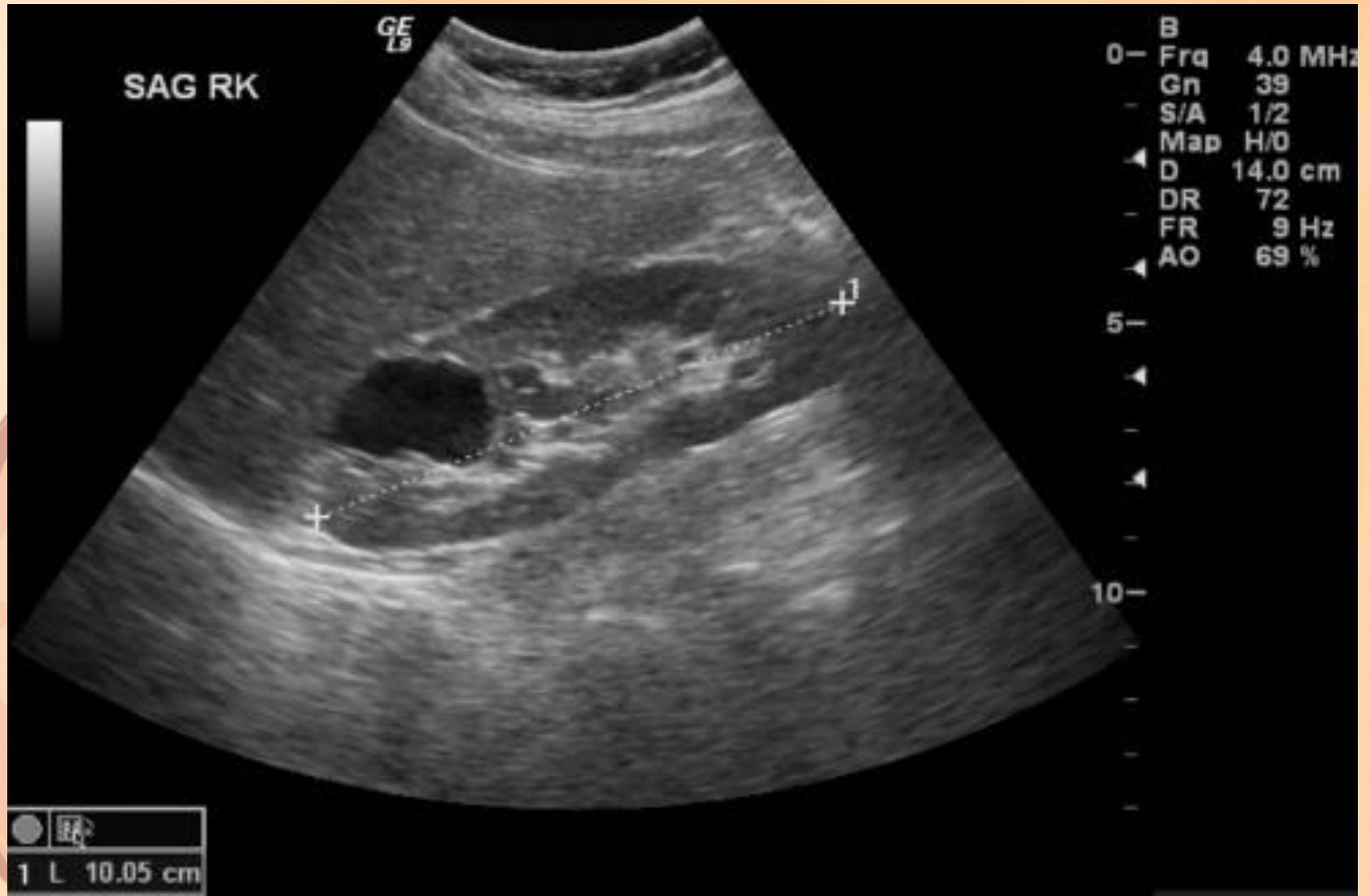


APN. Diagnosis

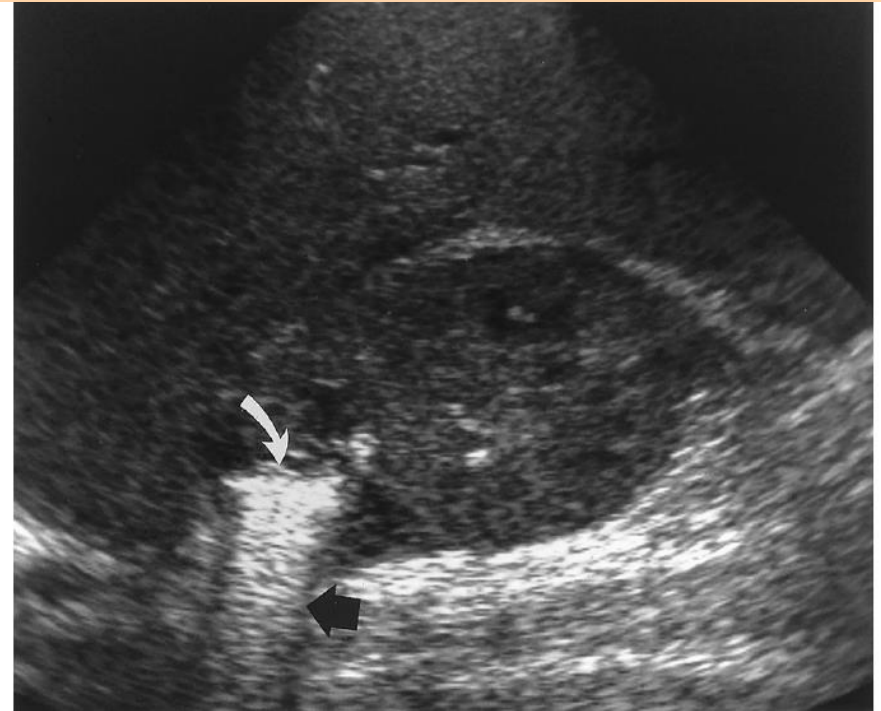
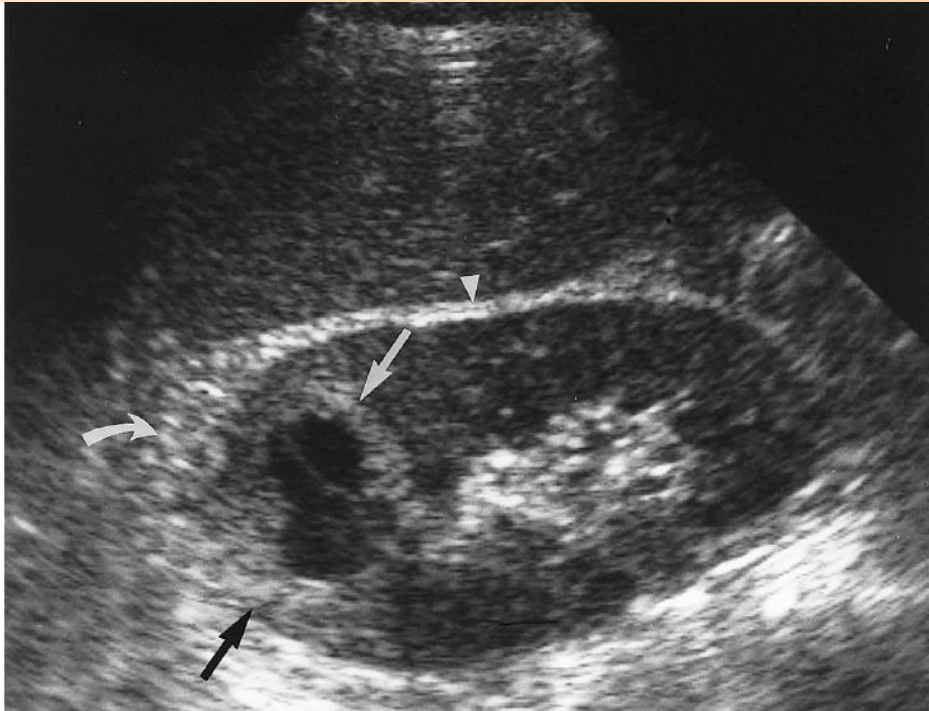
- Ultrasound picture of bilateral pyelonephritis.
- On sections through areas of gate of both kidneys moderately enlarged kidney sinuses with the expressed thickening and multiple layers of walls are visualized.
- The kidneys size is increased due to parenchyma, its ultrasound density last is raised.



Renal abscess



Renal abscess



© 2001 Lippincott Williams & Wilkins

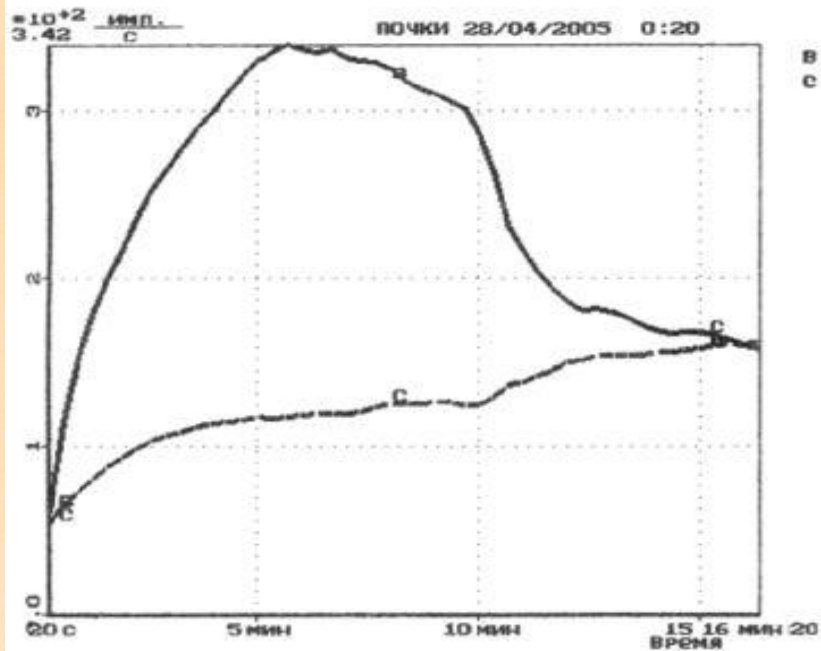
APN. Diagnosis

- Intravenous urography. Retrograde pyelography – reflux from the upper calyx.

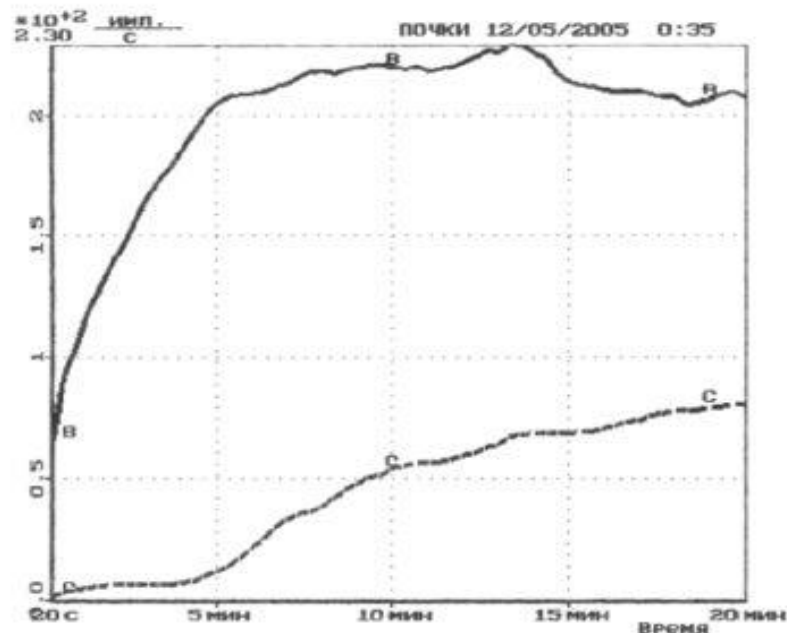


Izotope nephroscintigraphy of a patient P. 52 y/o, with purulent pyelonephritis

До лечения

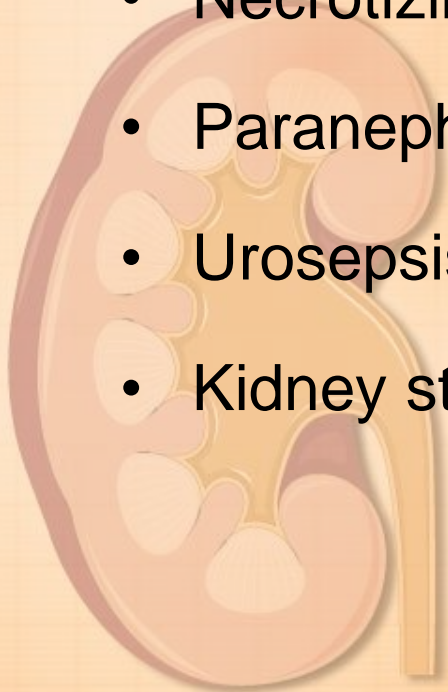


Через 12 мес



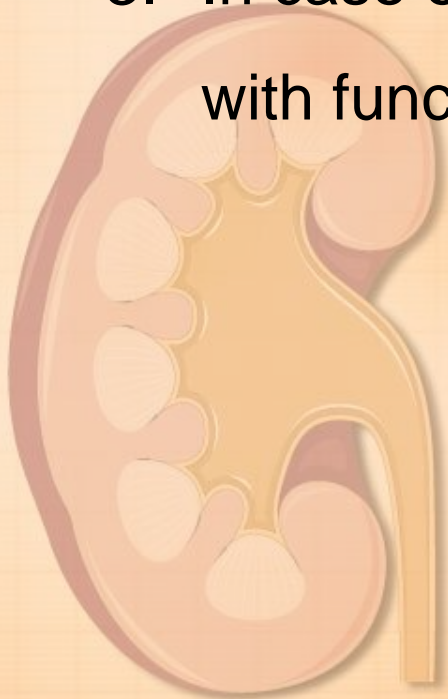
APN. Complications

- Chronic renal failure
- Acute renal failure
- Necrotizing papillitis
- Paranephritis
- Urosepsis
- Kidney stones



APN. Evolution

1. Complete recovery
2. Chronic disease
3. In case of a unilateral purulent injury – shrinkage with function loss



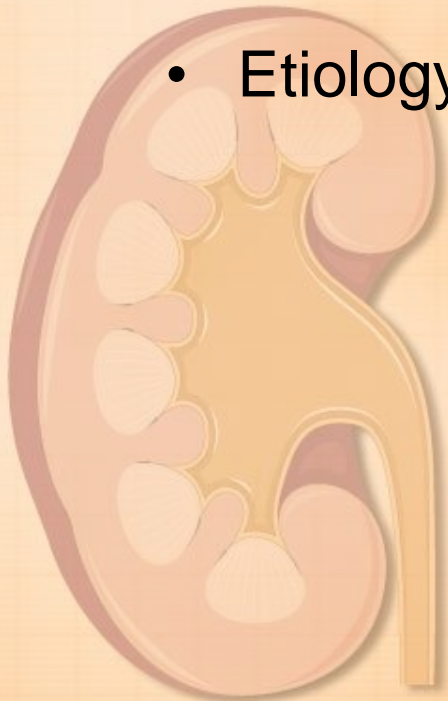


CHRONIC PYELONEPHRITIS

Chronic Pyelonephritis

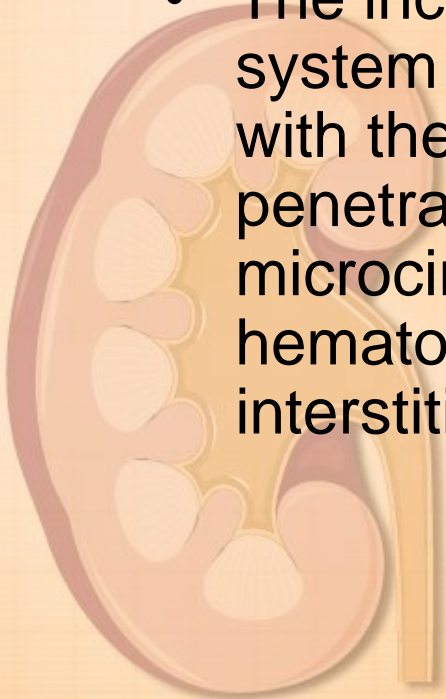
- Definition – infection-induced chronic inflammation of the renal interstitium and pelvocaliceal system.

- Etiology – the same as in APN



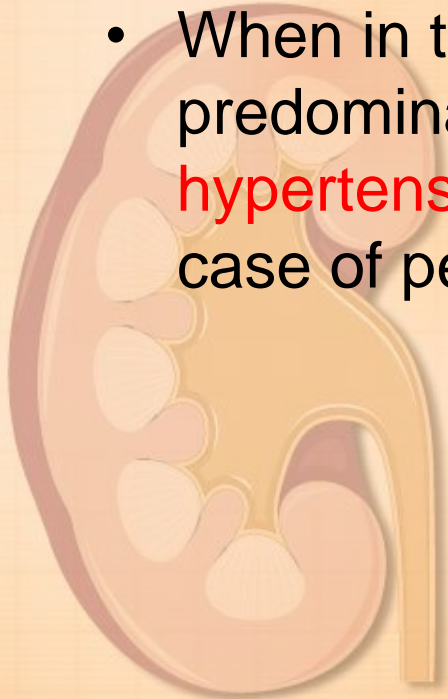
CPN Pathogenesis

- **Disorders of the normal urodynamics** favor the appearance of inflammation by infection of the stalled urine.
- The increase in the pressure in the pyelocaliceal system leads to compression of the fornical veins with their rupture, which favors the direct penetration of infection from pelvis to the renal microcirculation, causing secondary hematogenous infection of the renal cortex and interstitium.



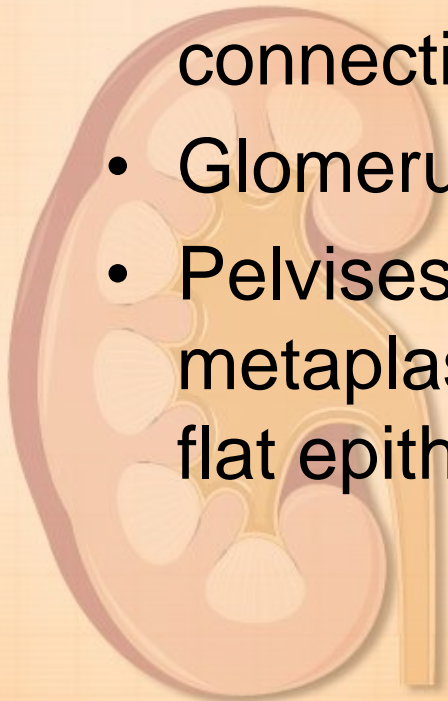
CPN pathogenesis

- A frequent cause of non-obstructive CPN is the vesical-ureteral reflux, which in time leads to kidney shrinkage.
- When in the shrunken kidney perivascular sclerosis predominates, the clinical picture of progressive hypertension appears, which is less prominent in case of periglomerular and peritubular sclerosis.



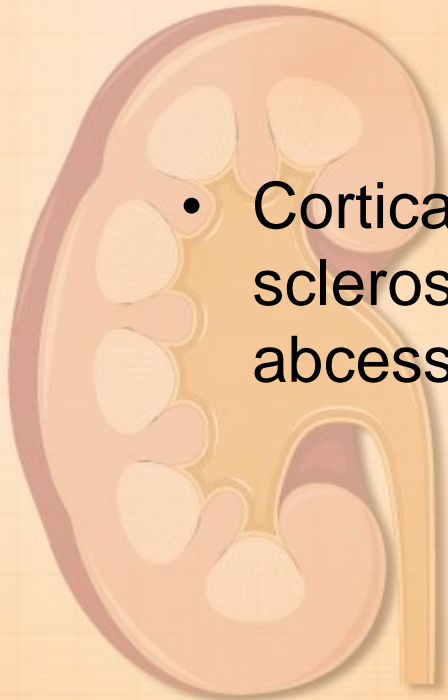
CPN. Pathologic anatomy

- Microscopically – lymphohistiocytic infiltrate, sclerosis and fibrosis of the stroma, as well as of the vessels, mainly arteriols
- Renal tubes – atrophic, substituted with connective tissue
- Glomerules – no changes
- Pelvises – sclerosis of the mucous with metaplasia of the transitional epithelium to flat epithelium.



CPN. Pathologic anatomy

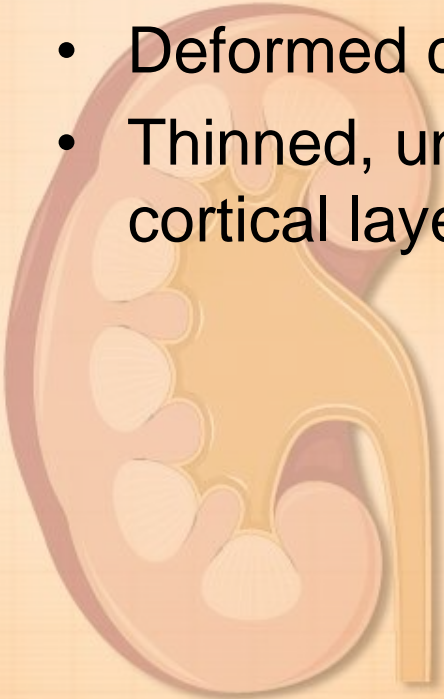
- Medullary stratum – lymphoid follicles, inflammatory infiltrates (lymphocytes, histiocytes, plasmatic cells), tubular sclerosis and atrophy, sclerosis of the vessels.



- Cortical stratum – periglomerular sclerosis, sclerosis of the vessels, randomly encapsulated abscesses.

CPN. Pathologic anatomy

- Macroscopically – multiple scars
- Shrunken kidneys
- Dilated pelvises
- Deformed calyces
- Thinned, uneven cortical layer

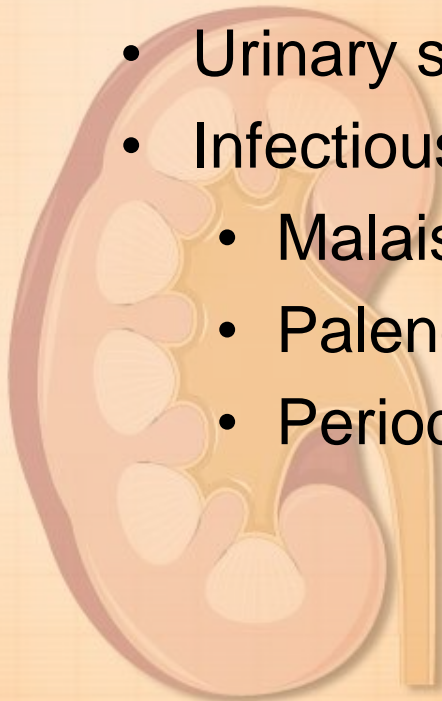


CPN. Clinical picture

CPN may appear following an APN, or as an independent condition.

CPN clinical picture during flare-ups:

- Urinary syndrome: leukocyturia, bacteriuria
- Infectious syndrome:
 - Malaise
 - Paleness, asthenia, fatigue
 - Periodic fever 37-38°C



CPN. Clinical picture

- Painful syndrome – moderate, non-colicative pain in the lumbar area (lumbar tenderness), on the affected side.
- Nicturia

In remission, the disease has no clinical picture.



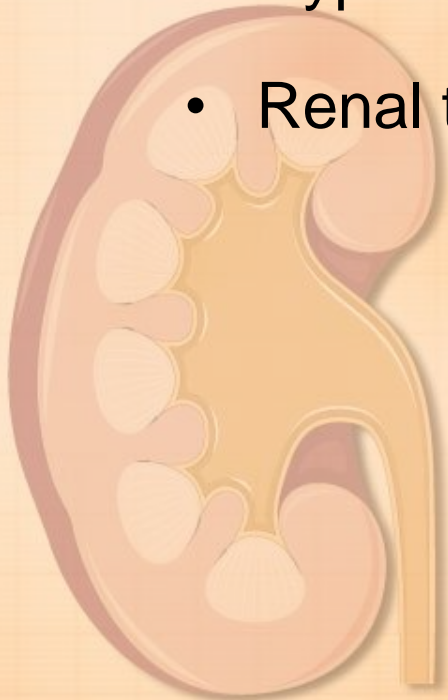
CPN. Evolutive types

- Latent
- Hypertensive
- Remission
- Anemic
- Azotemic
- Asymptomatic



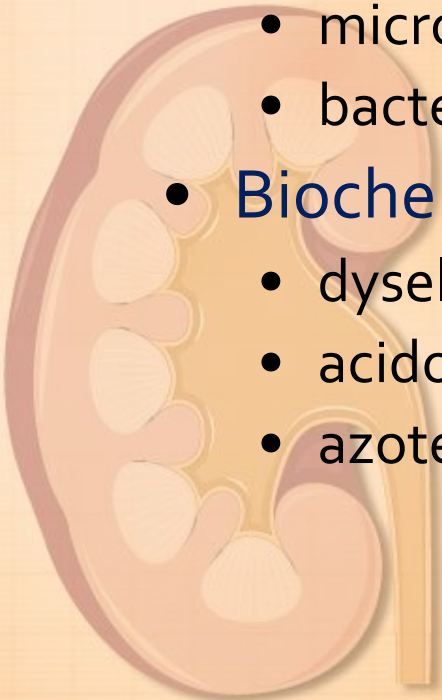
CPN. Differentials

- Chronic glomerulonephritis
- Diabetic glomerulosclerosis
- Hypertension
- Renal tuberculosis



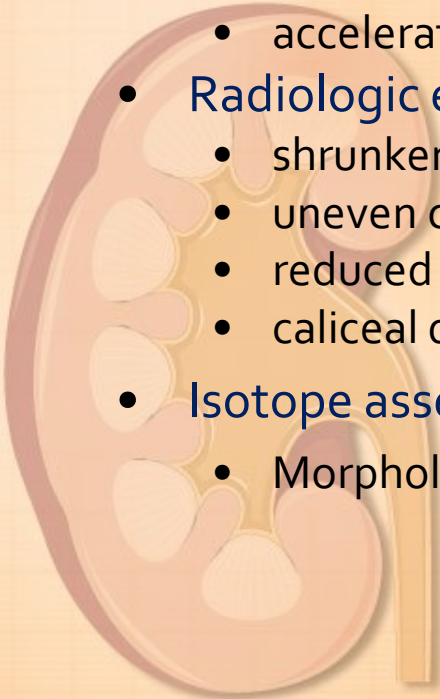
CPN. Positive diagnosis

- Urinalysis:
 - decreased urine osmolality
 - leukocyturia, pyuria
 - leukocyte cylinders
 - microscopic hematuria
 - bacteriuria
- Biochemistry:
 - dyselectrolytemia
 - acidosis
 - azotemia



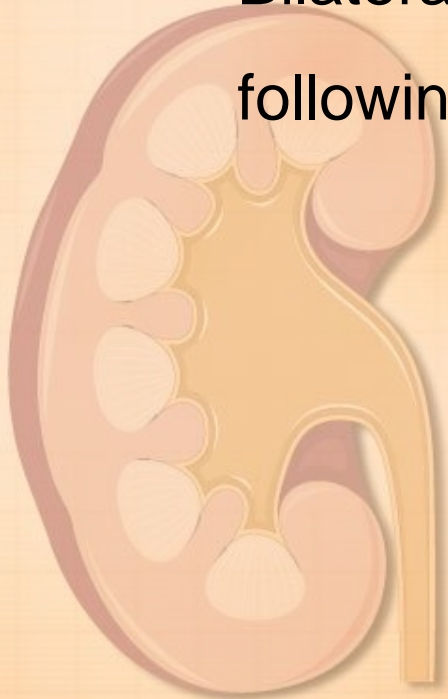
CPN. Positive diagnosis

- Renal function tests:
 - *Decreased GFR*
 - Elevated natriuresis
 - Deficient concentration tests, Zimnitki's test
- Blood tests:
 - moderate anemia, leukocytosis
 - accelerated ESR
- Radiologic examination:
 - shrunken asymmetric kidneys
 - uneven contour
 - reduced parenchimatous index
 - caliceal deformation
- Isotope assessments + US:
 - Morphologic and functional renal asymmetry



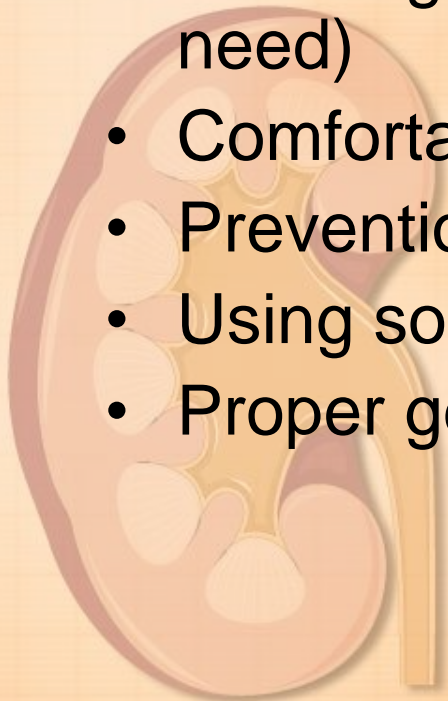
CPN. Evolution

- Secondary shrunken kidney
- Pyonephrosis
- Bilateral CPN leads to chronic renal failure following to a progressive loss of kidney function.



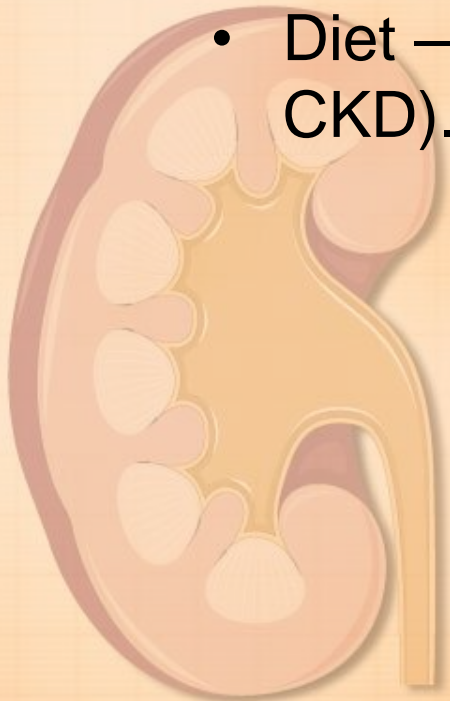
CPN. Prevention

- Treatment of chronic infections
- Rigorous intimate hygiene
- Sufficient water intake
- Avoiding over-filled urinary vesicle (voiding at need)
- Comfortable underwear
- Prevention of constipation
- Using soaps with a neutral pH for the toilet
- Proper genital hygiene



UTIs management.

- Regimen – depends on the patient's condition and activity of the pathologic process. In flare-ups – bed rest.
- Diet – physiologic, when uncomplicated (HT, CKD).



UTIs management. Antibiotherapy

Recommendations

of the European Association of Urologists.

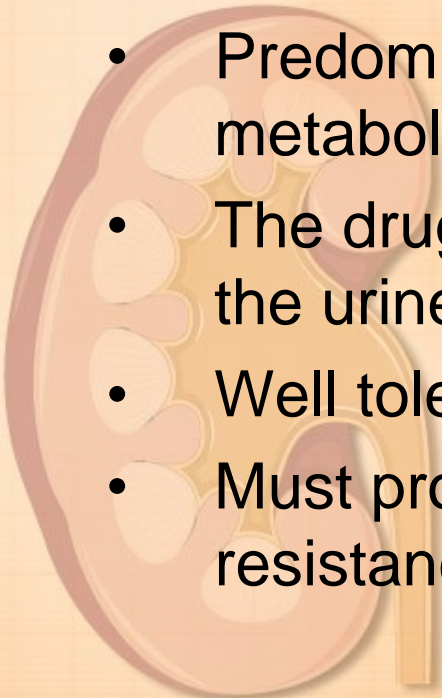
Empirical antibiotic therapy for acute uncomplicated cystitis in healthy premenopausal women (short course of oral antibiotic):

- *Fosfomycin trometamol (Monural - 3 g od)*
- *Nitrofurantoin (furadonin 50 mg q.i.d. - 7 days)*
- *Alternative therapy - fluoroquinolones (3 days) :*
 - ✓ Norfloxacin (400 mg b.i.d.)
 - ✓ Ciprofloxacin (250 mg b.i.d.)
 - ✓ Ofloxacin (200 mg b.i.d.)
 - ✓ Pefloxacin (400 mg b.i.d.)
 - ✓ *In case of local resistance to E.coli –*
Trimethoprim/Sulfamethoxazole 160/800 mg b.i.d.

UTIs management. Antibiotherapy

When choosing the antibacterial agent, a few principles should be met:

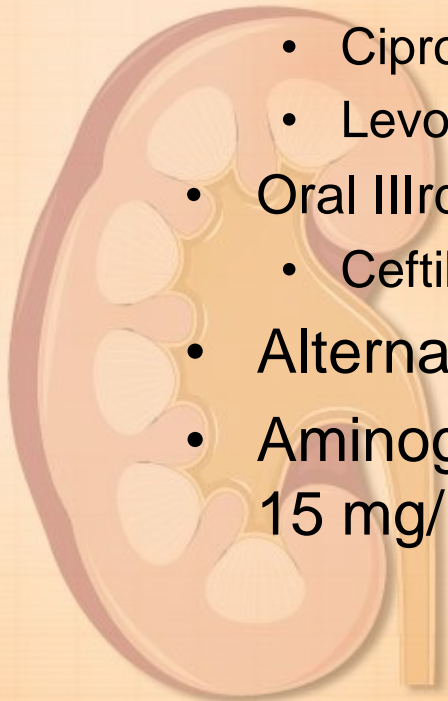
- The narrowest possible spectrum limited to the infectious agent isolated in urine specimens;
- Predominant urinary elimination as active metabolites;
- The drug should not precipitate in urine, no matter the urine pH;
- Well tolerated;
- Must produce the lowest possible microbial resistance.



UTIs management.

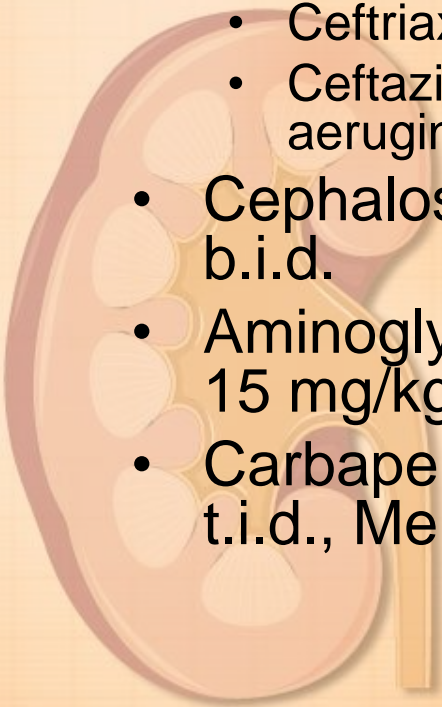
Mild to moderate uncomplicated CPN.

- Therapy duration 7-14 days
- Oral Fluoroquinolones
 - Ciprofloxacin 500 mg b.i.d.
 - Levofloxacin 500 mg od
- Oral 3rd generation Cephalosporins
 - Ceftibuten 400 mg od
- Alternatively i/m therapy
- Aminoglycosides: Gentamicin 5mg/kg/day, Amikacin 15 mg/kg/day



Severe uncomplicated CPN.

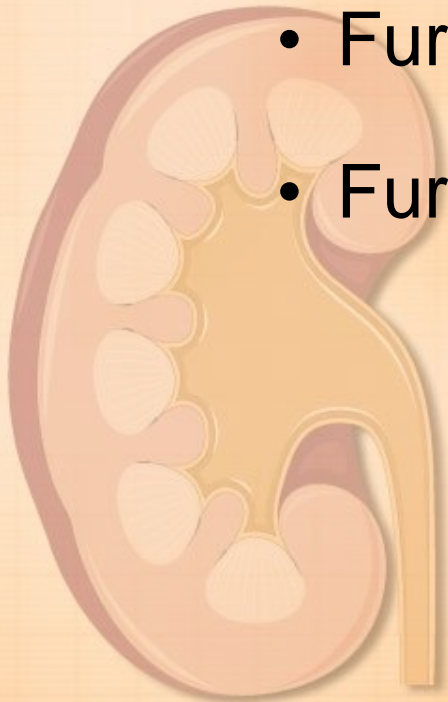
- Therapy duration - 14 days, i/m
- Fluoroquinolones
 - Ciprofloxacin 500 mg b.i.d.
 - Levofloxacin 500-750 mg od
- Cephalosporins of III generation :
 - Ceftriaxone 1-2gr od
 - Ceftazidime 1-2gr od (in the presence of *Pseudomonas aeruginosa* - 1-2 g t.i.d.)
- Cephalosporins of IV generation : Cefepime 1-2gr b.i.d.
- Aminoglycosides : Gentamicin 5mg/kg/day, Amikacin 15 mg/kg/day
- Carbapenems: Ertapenem 1gr od, Imipenem 500 mg t.i.d., Meropenem 1 gr t.i.d..



Asymptomatic bacteriuria

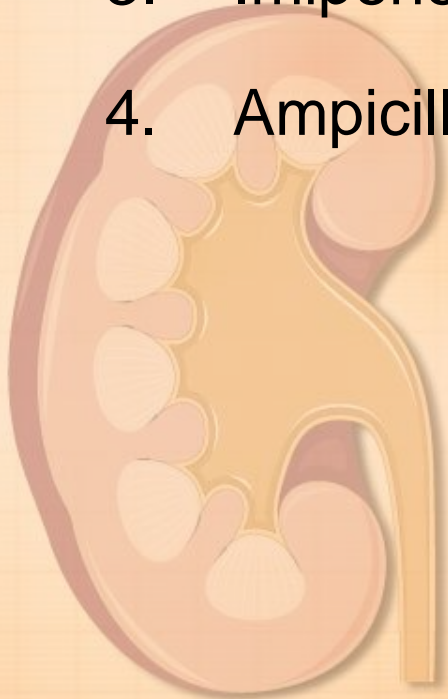
Therapy duration - 5 days

- Norfloxacin 400 mg b.i.d.
- Furagin 100 mg t.i.d.
- Furazidin 50 mg t.i.d.



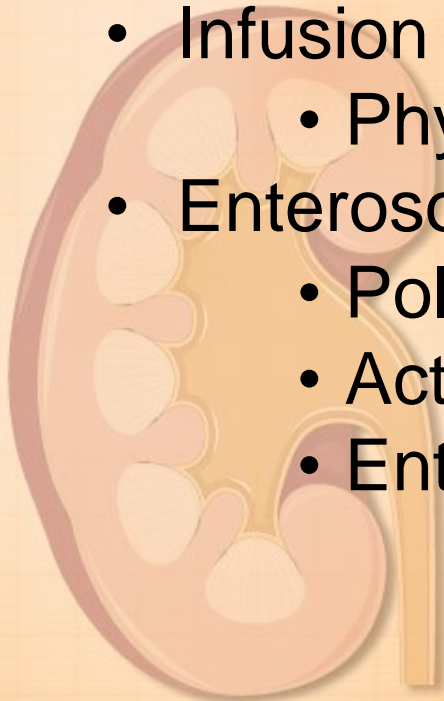
Antibacterial therapy for acute pyelonephritis in pregnant women

1. Ceftriaxone 1–2 gr i/v or i/m od
2. Cefepime 1gr i/v b.i.d.
3. Imipenem/cilastatin 500 mg i/v q.i.d.
4. Ampicillin 2 gr i/v q.i.d.



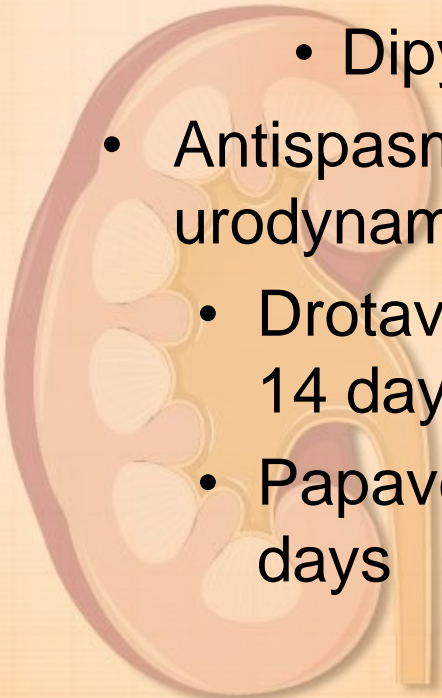
UTI: Desintoxication

- Oral rehydration
 - Plain water
 - Cranberry, strawberry juice
 - Rehidron – when dehydrated
- Infusion therapy / 500ml – 1 liter
 - Physiological saline, Glucose sol. etc.
- Enterosorption
 - Polyphepan 1 tbsp. 3 times a day
 - Activated charcoal up to 15 pills a day
 - Enterosgel 1 tbsp. 3-4 times per day, etc.



UTI therapy

- Antiaggregant
 - Acetylsalicylic acid - 75-125 mg od for 7-14 days
 - Pentoxifylline - 100 mg t.i.d. for 7-14 days
 - Dipyridamole - 75 mg t.i.d. for 10-20 days
- Antispasmodics – in lumbar pain, and altered urodynamics
 - Drotaverinum hydrochloride 2% 2ml t.i.d., i.m, 7-14 days
 - Papaverine hydrochloride 2% 2ml b.i.d., i.m, 7-14 days





Be healthy!