Urinary tract infections in children

Plan of the lecture

- 1. Definition of urinary tract infections in children
- 2. Risk factors and etiology
- 3. Pathogenesis
- 4. Classification
  5. Diagnostic criteria
- 6. Treatment and prophylaxis

Urinary tract infections (UTI)

- UTI take the 1-st place among another nephropathies
- They take 2-nd place among all types of inflammatory diseases
- There are 85% of hospitalizations to nephrologic departments due to UTI
- UTI morbidity is -19,1 cases for 1000 children
- For the last decade UTI morbidity is twice more among children and three times more among adolescents

В.Г. Майданник, 2005г.

Definition

- **UTI is inflammatory process in urinary tract without indication of affection level (upper or lower urinary tract, kidney parenchyma or bladder)**
- **So, UTI involve big group of diseases caused by microbial invasion into urinary system**

UTI
(Inflammatory process in urinary tract without indication of affection level)

Uncomplicated UTI of lower UT

- Cystitis
- Urethritis
- Urerthral syndrome

Complicated UTI of upper UT

- Pyelonephritis
- Abscesses or kidney carbuncle

UTI classification

Urethral syndrome:

- Acute
- Chronic – more than 2 months

Cystitis:

- Acute
- Chronic –more than 3 month

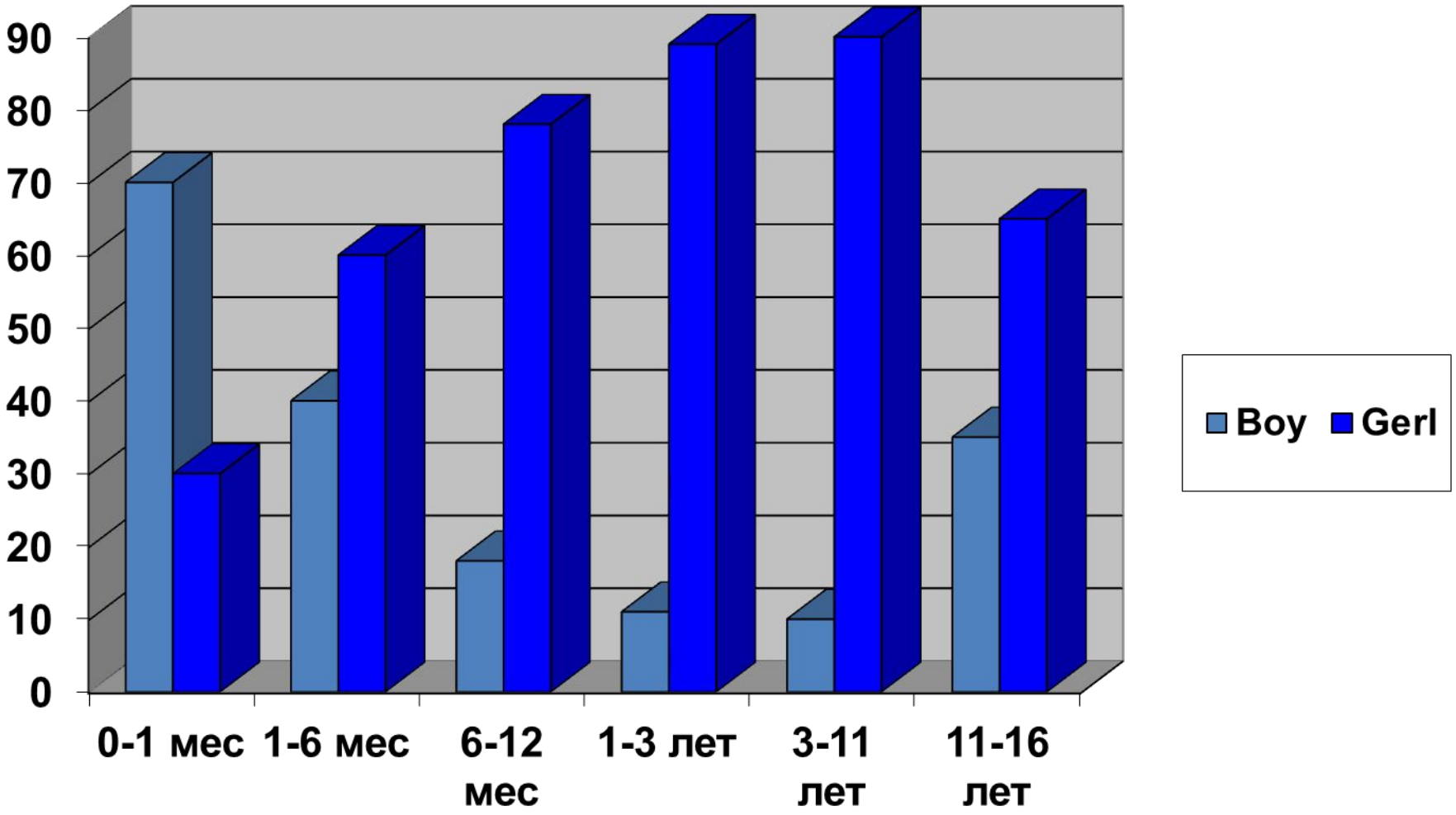
Pyelonephritis classification in children (2 Congress of Ukraine nephrologists, 2005)

Pyelonephritis forms	Disease periods	Kidney function
Primary (nonobstructive) pyelonephritis 1.Acute pyelonephritis	1.Active phase 2. Regressive period 3.Inactive phase	1.Preserved kidney function 2. Kidney function impairment 3.Acute kidney failure
Secondary (obstructive) pyelonephritis 2.Chronic pyelonephritis А)recurrent Б) latent	1.Exacerbation period 2.Partial clinical-laboratory remission 3.Full clinical-laboratory remission	1.Preserved kidney function 2. Kidney function impairment 3.Chronic kidney failure

Asymptomatic bacteriuria is presence of bacteria in urine in diagnostic titer without clinical manifestation and is one of the UTI clinical form

Symptom is confirmed if the same etiologic factor has been present in 2-3 samples of urine tests

UTI morbidity dependent from age and gender



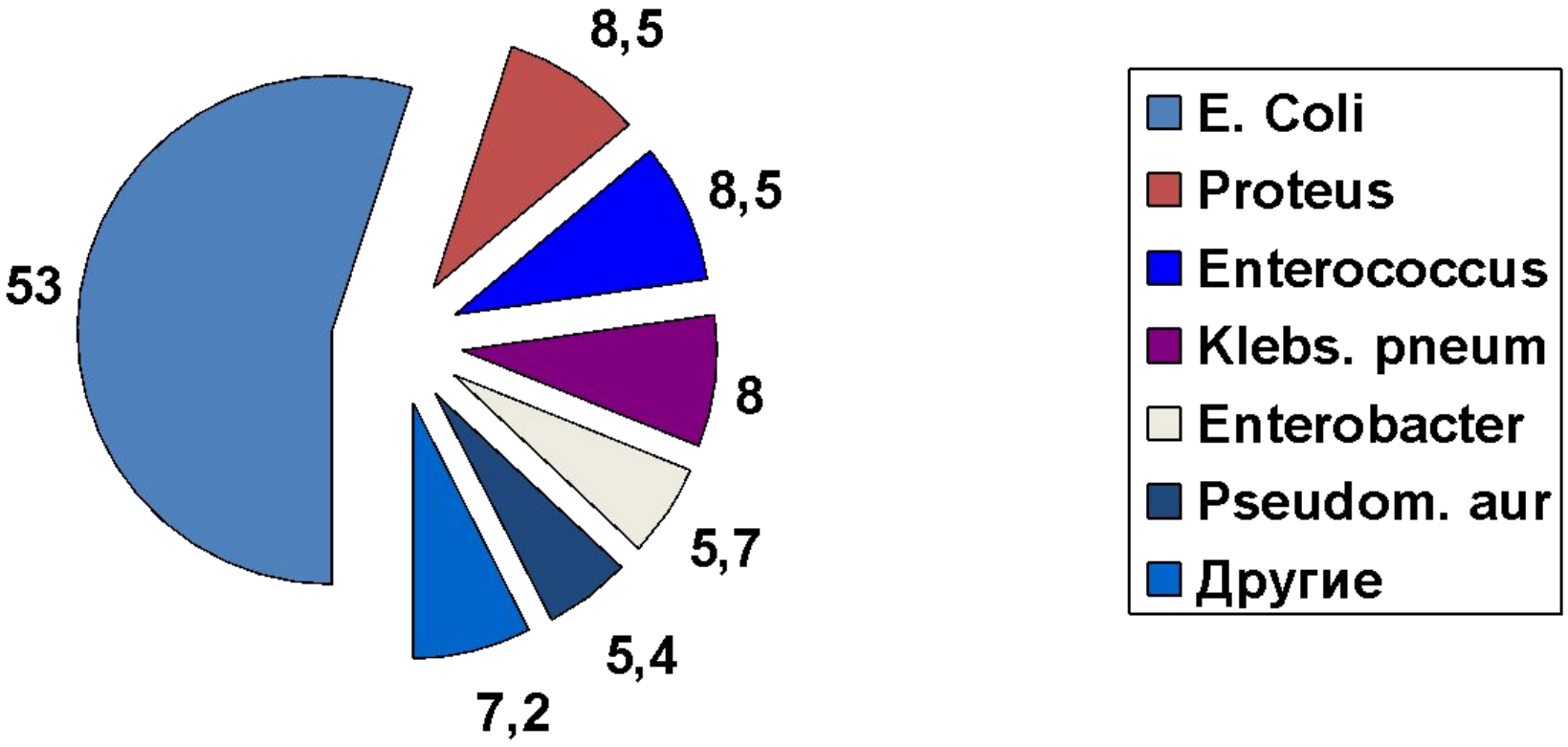
Risk factors of UTI:

- **Pyelonephritis in pregnant women**
- **Chronic infectious focuses especially urogenital in mothers**
- **Inflammatory diseases of girls like vulvitis, vulvovaginitis**
- **Toxicosis during I and II period of pregnancies**
- **Inherited predisposition for kidney diseases**
- **Metabolic disorders in parents and relatives**
- **Job hazard of mother during pregnancy**

Main ways of infectioning in UTI

- Hematogenic
- Urinegenic
- Lymphogenic

Pathogen frequency in UTI



Predisposing factors

- Vesicoureteric reflux
- Obstructive uropathy
- Neurogenic bladder
- Trauma of lumbosacral region
- Malnutrition
- Immunosuppressive therapy

Pathogenesis of UTI

UTI origin

Ureter or periureteral region

↑

Primary microbial localization or contamination

↓

Persistency and penetration due to P- fimbriae

↓

Penetration into urinary tract

↓

Microorganism virulence + organism sensibility to infection

↓

UTI development

Pyelonephritis pathogenesis

- **In ascendant way of infectioning due to vesicle-urethral reflux microorganisms enter upper UT epithelium and adhere on its surface. It cause functional obstruction of UTI**
- **Intrapelvis, intraureter pressure increases, it leads for pyelocaliceal obstruction and pyeloureteral , pyelotubular reflux. Due to this microbes can reach kidney and cause inflammation**

Phases of pyelonephritis pathogenesis:

- Initial, connected with microorganism adhesion
- Primary alteration and nonspecific answer
- Specific or immunologic phase

Main differentiative features of upper and lower UTI clinical signs

- In upper UTI inflammatory reaction will be systemic of the whole organism.
- In lower UTI only topical reactions will be present

To confirm UTI diagnostic titer of bacteria count in urine is:

- > 10^4 bacteria/ml taken as a middle part of urine stream
- >10^3 bacteria/ml of urine taken by catheter
- Any quantity of bacteria in 1 ml of urine taken by suprapubic bladder aspiration

- For Proteus, Pseudomonas auriginosa, Clebsiella - 10^3/ml
- Candida albicans in urine taken by catheter– any quantity

Main diagnostic criteria of UTI in children

Urethritis (Urethral syndrome)

- Pains before urination
- Imperative urination
- Neutrophyl (>50%) leucocyturia
- Frequent urination
- Discharges from urethra
- Bacteriuria

Cystitis

- Pains at the end of urination
- Disuria
- Pains in abdomen, suprapubic area after bladder filling
- Absense of intoxication
- Bacteriuria, neutrophyl leucocyturia, terminal hematuria

Pyelonephritis

- Intoxicative syndrome (fever >38°C; frequently without visible cause, head ache, flaccidity)
- Painful syndrome (lumbal pains, pains around umbilicus)
- Disuria syndrome (especially in lower urinary tract infection)
- Urine syndrome (bacteriuria, neutrophyl leucocyturia, proteinuria less than 1 g/l,minimal erythrocyturia)

Pyelonephritis peculiarities in infants and toddlers

- Fever, flaccidity, irritation
- Can start with neurotoxicosis or intestine syndrome with toxicosis, has inclination for generalization of inflammatory process)
- Anxiety during urination, crying and agitation before urination, redness of face as equivalent of disuria disturbances
- Periorbital edema

Pyelonephritis peculiarities in schoolchildren and adolescents

- **Fever, head ache, flaccidity, fatigability, shadows around eyes**
- **Abdomen pains**
- **Urether projection pains**
- **Tapotement positive symptom**
- **Dysuria more commonly together with law urinary tract obstruction**

Additional diagnostic methods of UTI

- **Ultrasound examining of kidneys and bladder**
- **Radionuclide rhenography –evaluate functional condition of each kidney (secretion and excretion)**
- **Excretory urography- reveals anmatomic structure abnormalities or peculiarities of kidney and calico-pelvic system**
- **Mixture cystography-reveals presense of vesico-urethral reflux (VUR)**
- **Cystoscopy – evaluate mucous membrane condition of bladder, urethers aperture, structure anamalies**

UTI treatment

- Regimen – for period of intoxication is strict bed one
- Diet–special diet №5 according to Pevzner in preserved kidney function and №7 in the case of impaired nitrogen secretion function
- Etiotropic therapy –antibiotics
- Pathogenic therapy- desintoxication by lipin, rheosorbilact, 5% glucose IV injections

Rational antibiotic treatment

- Antibiotic choice is performed according to causative bacteria sensibility;
- Antibiotic choice is performed with considerations of its capacity to penetrate into UT and perform effective concentrations in urine;
- Dosages and regimens of antibiotics must be prescribed according to pharmacokinetics of medication;
- Antibiotic treatment must be prompt and its duration dependent on course and severity of disease;
- Antibiotic change or correction must be prompt if previous one is clinically ineffective

Antimicrobial treatment of urethritis (urethral syndrome)

- **Antibiotics (amoxyclav or zinnat) or may be uroseptics like co-trimxozol, nitrophurantoin, furamag for 5 days together with topical treatment**

Empiric start antibiotic therapy of acute cystitis

First line medications	Reserve medications
«Protected penicillines»: (5days) -AMOXICLAV, AUGMENTIN	Cephalosporins of 2 generation (per os) ZINNAT, CEFACLOR, VERCEF, CEFUTYL
PHOSPHOMYCIN (MONURAL)	Cefalosporins of 3 generation– CEFTIBUTEN (CEDEX)
Nitrophurane medications: Furagin, Furamag	Co-trimaxozol (biseptol, Bactrim, lidapril)

«STEP» -therapy of Pyelonephritis

- **Means usage of parenteral antibiotic usage during high inflammatory activity and after partial condition improving (3-5 days after start therapy) oral way of antibiotic intake of the same drug**

It looks like these

- **Intravenous (3-5 days)**
- **Oral administration**

Acute pyelonephritis empiric (start) antibacterial treatment

First line medications	Reserve medications
«Protected penicyllines»: **Amoxicylline/clavulonic acid, amoxicylline/sulbactam**	Aminoglycozides: **Garamycin, Amycacin, Netylmycin Netromycin**
Cefalosporins of 2 generation: **Cefuraxim (ZINACEF) Cefamandol**	Cefalosporins of 4 generation: **Cefepim Cefpirom**
Cefalosporins of 3 generation: **Cefataxim, Ceftrixone**	Carbepenems: **Imipenem**

Indications for combined antibacterial therapy in children with pyelonephritis

- Severe septic course of inflammatory process in kidneys. Main goal is to intense synergism of antibacterial drugs;
- Severe course of disease due to microbe associations;
- To prevent resistance of microorganisms to antibiotics especially in the cases of such infections like Proteus, Pseudomonas auriginosa, Klebsiella
- To eradicate intracellular microorganisms like (Chlamidia, Mycoplasma, Ureaplasma)

Antibiotic treatment duration in pyelonephritis

- **Antimicrobial drugs must be used until full eradication of microbial agents in urine and full resolution of active pyelonephritis**
- **In children unlike to adults there are no clinical or bacteriological evidences of short treatment courses efficacy**
- **Antibacterial medications prescribed for 2-4 weeks with changes of peculiar drugs every 7-10 days taking into account sensibility of microflora**

Antibiotic treatment duration in pyelonephritis

- **If effect of treatment is absent 14 days later or if pyelonephritis course is recurrent treatment must be prolonged for 6 weeks and more**
- **After persistent antibacterial treatment course is finished preventive therapy is performed by uroseptics. Proposed regimens: 10 days of every month for 3-6 months or ½-1/4 of daily dosage before sleeping for 1-3 months. Alternative choice is phyto medication – CANEFRONE**

Complications

- **Apostematous nephritis (lots of abscesses in kidney) – is acute septic disease**
- **Carbuncle manifests with squeezed calyces and pelvis or amputation of one or two calyces in urogram**
- **Paranephritis**
- **Nephrocalcinosis**
- **Nephrogenic hypertension**
- **Chronic renal failure due to atherosclerotic kidney in chronic pyelonephritis**

Outpatient care

- After primary acute pyelonephritis children must get outpatient care for 3 years, in the case of secondary pyelonephritis -5 years. If recurrence of disease is absent for this period it can be ascertained full recovery.

- Outpatient care after cystitis is performed for 1 year in children

Urine examining must be performed :

- 2 – 3 weeks later after intercurrent disease
- When child needs official registration to some establishments
- Before surgery
- Not less than twice per year to all children

Questions

- **Etiology of the urinary tract infection in children.**
- **Mechanism of the pathologic process development at urinary tract infection in children.**
- **Criteria of the diagnostic, nomenclature and classification of the urinary tract infection.**
- **Clinical symptoms of the different types of urinary tract infection.**
- **Principles and methods of the diagnostic of urinary tract infection.**
- **Principles and methods of the urinary tract infection treatment.**
- **The principles of the urinary tract infection complications prophylaxis.**