

URINARY TRACT INFECTIONS IN CHILDREN: CLINICAL ASPECTS

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ABSTRACT

Urinary tract infections (UTIs) in children are among the most common reasons for seeking medical care and may present as manifestations of both acute and chronic conditions. In pediatric practice, UTIs represent a significant clinical problem due to their high recurrence rate, risk of complications, and potential development of nephropathies. This article reviews current data on the clinical manifestations, diagnostic approaches, and treatment of urinary tract infections in children. Particular attention is given to age-related features of disease progression, differential diagnosis, and management strategies for recurrent forms. Criteria for timely identification of pyelonephritis and cystitis are presented, along with recommendations for rational antibiotic therapy.

KEYWORDS: Urinary tract infections, children, pyelonephritis, cystitis, diagnosis, treatment, recurrences, antibiotic therapy.

RELEVANCE

Urinary tract infections (UTIs) are among the most common pathologies in children, second only to acute respiratory infections in terms of frequency. According to various authors, up to 7–8% of girls and 2% of boys experience at least one episode of UTI during childhood, with the highest incidence observed in the first three years of life.^[6,9] Given the anatomical and physiological characteristics of the pediatric population—such as an immature immune system, short urethra in girls, and frequent functional disorders of the urinary tract—the risk of recurrence and progression from acute to chronic inflammation remains high.^[2,7]

Particularly concerning is the fact that in young children, the clinical picture is often nonspecific and can mimic other diseases, leading to delayed diagnosis. Moreover, UTIs in early childhood, especially pyelonephritis, may result in irreversible scarring of renal tissue, arterial hypertension, and chronic kidney disease in adolescence or adulthood.^[1,10]

Difficulties in selecting appropriate antibacterial therapy, the growing resistance of microorganisms to standard medications, and the limited data on age-specific symptomatology and risk factors for UTIs highlight the need for a detailed analysis of the clinical aspects of these infections in children.^[4,5] Improving early diagnosis and treatment strategies is essential to reduce the incidence of complications, enhance quality of life, and prevent the chronic progression of the disease.^[3,8]

RESEARCH OBJECTIVE

To study the clinical features of urinary tract infections in children of different age groups in order to optimize diagnosis, treatment, and prevention of recurrences.

MATERIALS AND METHODS

This study was a prospective clinical and laboratory investigation conducted at the pediatric department of the multidisciplinary children's hospital of the Republic of Karakalpakstan from January 2023 to May 2024. The research included the collection of medical history, which focused on identifying risk factors (hereditary, medical-biological, infectious, and allergological), as well as comprehensive clinical and laboratory examination of the child.

A total of 214 children aged from 1 month to 15 years were included in the study. All were hospitalized with a diagnosis of urinary tract infection (UTI), including acute cystitis, pyelonephritis, and asymptomatic bacteriuria. Inclusion criteria comprised clinical signs of UTI (fever, dysuria, abdominal or lower back pain), laboratory confirmation (leukocyturia, bacteriuria), and/or ultrasound findings of the urinary tract. Children with congenital anomalies of the kidneys or neurogenic bladder were excluded from the study sample.

RESULTS

Analysis of our data showed that the clinical manifestations of urinary tract infections (UTIs) in the examined children were nonspecific during the first year

of life. In children under the age of two, the most common symptom was unexplained fever or elevated body temperature without an obvious source of infection, which was often the only manifestation of UTI. After the age of two, the symptoms became more specific.

Pyelonephritis was characterized by fever (sometimes low-grade), the absence of catarrhal symptoms, chills, vomiting, general malaise, flank or back pain, and tenderness in the costovertebral angle region. (See Table 1.)

Table 1: Age-Related Dynamics of Clinical Presentation and Diagnostic Specificity in Pediatric Urinary Tract Infections.

Age Group	Typical Presentation	Diagnostic Features
Infants (<2 years)	Isolated febrile episodes, poor feeding	Often non-urinary symptoms, diagnosis frequently delayed
Toddlers (2–3 yrs)	Fever with systemic signs (chills, vomiting)	UTIs not commonly suspected in differential diagnosis
Children (>3 yrs)	Classic urinary complaints: dysuria, flank pain	High index of suspicion, easier to confirm

The mild and nonspecific clinical manifestations of kidney and urinary tract diseases in children under the age of three complicate timely diagnosis, contributing to the chronicity of the process due to delayed initiation of appropriate therapeutic correction.^[5,7] A distinctive feature of renal diseases in infants is the particular background of morphological immaturity of renal tissue and the functional underdevelopment of nephrons.^[9,10]

According to the current classification, urinary tract infections (UTIs) are divided into acute and chronic pyelonephritis (a condition involving the renal parenchyma) and lower urinary tract infections (an infectious process limited to the urinary tract, such as pyelitis, urethritis, cystitis, and ureteritis). The most common diagnosis in children is chronic pyelonephritis, followed by UTIs, and then acute pyelonephritis.

An etiological approach to the diagnosis of renal urinary tract infections is fundamental to their successful

treatment. The primary causative agents of pyelonephritis are enterobacteria and enterococci, while purulent-inflammatory diseases are often caused by *Staphylococcus aureus*. Minor uropathogens include coagulase-negative staphylococci, *Pseudomonas* species, and other non-fermenting gram-negative bacteria in combination with *Candida* species.

Uncomplicated urinary tract infections were caused by a single microorganism in more than 95% of cases, most commonly (60–87.3%) from the Enterobacteriaceae family, and less frequently (40–13.7%) by *Staphylococcus saprophyticus* and others. In complicated urinary tract infections, *Proteus* spp., *Pseudomonas* spp., *Klebsiella* spp., and fungi were more frequently identified.

Empirical therapy was effective in 75% of cases; however, in 25% of patients, treatment had to be adjusted based on antibiotic susceptibility testing. (See Table 2.).

Table 2: Urine Laboratory Parameters in Children with UTIs Before and After Treatment.

Urine Parameter (Nechiporenko Test)	Normal Values	Before Treatment (Mean ± SD)	After Treatment (Mean ± SD)
Leukocytes, per 1 ml	<2000	8500 ± 3000	1500 ± 700
Erythrocytes, per 1 ml	<1000	2800 ± 1200	900 ± 400
Casts, per 1 ml	<20	60 ± 25	15 ± 10

The table presents the mean laboratory values of urine analysis by the Nechiporenko method in children with urinary tract infections before and after the course of treatment. Prior to therapy, patients exhibited a significant elevation in leukocyte levels — an average of 8500±3000 per 1 ml, indicating a pronounced inflammatory process in the urinary tract. Similarly, the number of erythrocytes was elevated, averaging 2800±1200 per 1 ml, which points to the presence of microhematuria associated with mucosal damage in the urinary tract. The number of casts also exceeded normal values — 60±25 per 1 ml — reflecting impaired renal tubular function and ongoing inflammation in the kidneys.

After completion of the treatment course, a significant improvement in laboratory parameters was observed. The leukocyte concentration decreased to 1500±700 per 1 ml, which indicates that the level of inflammation had nearly returned to normal. The number of erythrocytes dropped to 900±400 per 1 ml, reflecting the restoration of the integrity of the urinary tract mucosa and a reduction in microhematuria. The number of casts also normalized to 15±10 per 1 ml, indicating recovery of renal function and a decrease in the inflammatory response.

The dynamics of the Nechiporenko urine parameters before and after treatment reflect the effectiveness of the therapy aimed at eliminating the infection and restoring

the function of the urinary system in children with urinary tract infections.

The most common pathogens identified were *Escherichia coli* and *Klebsiella pneumoniae*, with increasing resistance to amoxicillin. The frequency of isolation of *Escherichia coli* and *Klebsiella pneumoniae* varies depending on the type of infection and the age of the patient.

In cases of complicated UTIs, *Escherichia coli* was the causative agent in 47.1% of cases, whereas in non-obstructive pyelonephritis, it was responsible for approximately 80% of infections. Optimization of dosage regimens and reduction of treatment duration contributed to a decrease in side effects and recurrence rates.

The results of the study showed that the clinical manifestations of UTIs vary with the child's age: in infants, nonspecific symptoms predominate, making early diagnosis more difficult, while in older children, typical urological complaints are more common.

Escherichia coli remains the leading bacterial pathogen; however, a growing resistance to commonly used antibiotics has been observed, highlighting the importance of local monitoring of antibiotic resistance patterns and rational selection of empirical therapy.

The involvement of primary healthcare providers (general practitioners) is of crucial importance in the examination of the urinary system in children, as they are most accessible to the target population and have the capacity to carry out early diagnosis of kidney pathology in pediatric patients.

CONCLUSION

Urinary tract infections in children remain a pressing issue in pediatric practice due to their high prevalence, risk of recurrence, and potential long-term complications. The prognosis of the disease and associated renal dysfunction depends on the state of the immune system, the achievement of clinical and microbiological remission, and the effectiveness of pathogen eradication from the infection source.

Rational antibiotic therapy of UTIs in children—based on empirical prescription followed by appropriate adjustment—proves to be an effective strategy. It is crucial to regularly review treatment protocols based on regional data on antimicrobial resistance in order to improve clinical outcomes and prevent the development of antibiotic resistance.

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