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CYSTITIS IN CHILDHOOD: CURRENT ASPECTS OF ETIOLOGY, PATHOGENESIS, CLINICAL PICTURE, DIAGNOSIS AND TREATMENT

Abstract. Cystitis is one of the most common urinary tract infections (UTIs) in children and is an inflammation of the bladder mucosa, primarily of bacterial etiology. The disease can occur as an independent lower urinary tract disorder or as a manifestation of a more widespread infectious process. *Escherichia coli* remains the primary causative agent, but the importance of other gramnegative microorganisms and antibiotic-resistant strains is increasing. Diagnosis is based on clinical evaluation, urinalysis, urine culture, and instrumental examinations when indicated. Current international guidelines emphasize the importance of rationally prescribing antibacterial therapy, taking into account local antibiotic resistance and urine culture results.

Keywords: children, cystitis, urinary tract infection, *Escherichia coli*, bladder, diagnosis, antibacterial therapy.

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ЦИСТИТ В ДЕТСКОМ ВОЗРАСТЕ: АКТУАЛЬНЫЕ АСПЕКТЫ ЭТИОЛОГИИ, ПАТОГЕНЕЗА, КЛИНИЧЕСКОЙ КАРТИНЫ, ДИАГНОСТИКИ И ЛЕЧЕНИЯ

Аннотация. Цистит является одной из наиболее распространённых инфекций мочевыводящих путей (ИМП) у детей и представляет собой воспаление слизистой оболочки мочевого пузыря преимущественно бактериальной этиологии. Заболевание может возникать как самостоятельная патология нижних мочевых путей или быть

проявлением более распространённого инфекционного процесса. Основным возбудителем остаётся *Escherichia coli*, однако возрастает значение других грамотрицательных микроорганизмов и устойчивых к антибиотикам штаммов. Диагностика основывается на анализе клинической картины, общем анализе мочи, бактериологическом исследовании мочи и инструментальных методах обследования при наличии показаний. Современные международные рекомендации подчёркивают важность рационального назначения антибактериальной терапии с учётом локальной антибиотикорезистентности и результатов посева мочи.

Ключевые слова: дети, цистит, инфекция мочевыводящих путей, *Escherichia coli*, мочевого пузыря, диагностика, антибактериальная терапия.

Introduction

Urinary tract infections are one of the leading bacterial diseases in childhood. According to international studies, approximately 7–8% of children experience at least one urinary tract infection before reaching the age of eight, and the prevalence is significantly higher among school-age girls than among boys [1–5]. Cystitis is the most common form of lower urinary tract infection and is characterized by inflammation of the bladder mucosa without involvement of the renal parenchyma.

According to current guidelines from the European Association of Urology (EAU) and the European Society of Paediatric Urology (ESPU), diagnosis and treatment should be based on laboratory confirmation of infection, assessment of risk factors for complications, and rational selection of antibacterial therapy [6–11]. A modern approach to managing children with cystitis includes a comprehensive assessment of clinical symptoms, laboratory confirmation of infection, individualized selection of antibacterial therapy, correction of functional urinary disorders, and preventive measures. Particular attention is paid to children with recurrent urinary tract infections, who may require additional urological examination and long-term follow-up.

Etiology

The main cause of cystitis in children is a bacterial infection. In more than 80-90% of cases, the causative agent is *Escherichia coli*, which has pronounced virulence factors that ensure adhesion to the bladder urothelium [11-16].

In children with immunodeficiency, after prolonged antibiotic therapy, or bladder catheterization, fungal infections (*Candida* spp.) are possible, and in patients after organ transplantation or severe immunosuppression, viral cystitis (adenovirus, BK polyomavirus) has been described.

Risk Factors

The development of cystitis is determined not only by the presence of the microorganism but also by the disruption of the natural defense mechanisms of the urinary tract [16-20].

The main risk factors include:

- Female gender;
- Short and wide urethra;
- Congenital anomalies of the urinary system;
- Vesicoureteral reflux;
- Bladder dysfunction;

Chronic constipation;
Infrequent urination;
Post-void residual urine;
Urolithiasis;
Diabetes mellitus;
Immunodeficiency states;
Bladder catheterization;
Poor intimate hygiene.

Pathogenesis

The leading mechanism for the development of cystitis is an ascending infection.

Uropathogenic microorganisms colonize the periurethral region, then penetrate the bladder through the urethra and attach to the urothelium.

After bacterial attachment, innate immunity is activated.

Bladder epithelial cells begin to produce proinflammatory cytokines (IL-6, IL-8, TNF- α), which promote neutrophil migration and the development of an inflammatory response. This leads to dysuria, frequent urination, and pain. Normally, the urinary tract has a number of protective mechanisms:

Regular bladder emptying;
Bactericidal properties of urine;
Intact urothelium;
Local mucosal immunity;
Production of antimicrobial peptides;
Secretion of immunoglobulin A.

If any of these mechanisms is disrupted, the likelihood of developing cystitis increases significantly.

Clinical presentation

The clinical manifestations of cystitis in children depend on the patient's age, the type of disease, the severity of the inflammatory process, and the presence of concomitant urinary tract pathology.

Acute cystitis

Acute cystitis is characterized by a sudden onset of the disease. The main symptoms are:

Frequent urination (pollakiuria);
Painful urination (dysuria);
Urgent urination;
Small amounts of urine;
Pain or heaviness in the suprapubic region;
Terminal hematuria;
Cloudy urine;
Foul-smelling urine.

Body temperature in uncomplicated cystitis usually remains normal or makes a slight increase. High fever ($>38^{\circ}\text{C}$), chills, lower back pain, or symptoms of intoxication require ruling out acute pyelonephritis.

In young children, the disease may manifest itself as:

Anxiety;

Crying during urination;

Refusal to eat;

Sleep disturbances;

Low-grade fever;

Episodes of urinary incontinence.

In children in the first months of life, the only manifestation of a urinary tract infection may be an unexplained fever.

Modern Diagnostics

Diagnosis of cystitis should be comprehensive and include a clinical examination, laboratory tests, and, if necessary, instrumental methods.

History

Particular attention is paid to:

Frequency of urination;

Nature of pain;

Presence of fever;

History of UTIs;

Congenital anomalies of the urinary system;

Episodes of constipation;

Urination disorders;

Family history of kidney disease.

Laboratory diagnostics

Urinalysis is a mandatory diagnostic method.

The most characteristic changes are:

Leukocyturia;

Bacteriuria;

Microhematuria;

Moderate proteinuria;

Positive leukocyte esterase test;

Positive nitrite test (in case of gram-negative infection).

Instrumental Diagnostics

Ultrasound

Ultrasound of the kidneys and bladder is the method of choice for the first episode of infection in young children, as well as for recurrent infections.

It helps identify:

congenital malformations;

residual urine;

thickening of the bladder wall;

Modern approaches to treating cystitis in children

The main goals of treatment are:

eradication of the pathogen;

relief of inflammation;

elimination of clinical symptoms;
prevention of ascending infection;
prevention of relapses and the development of chronic inflammation.

Current guidelines from the European Association of Urologists (EAU/ESPU), NICE, and the European Society for Paediatric Infectious Diseases (ESPID) emphasize that treatment should be individualized based on the child's age, severity of the disease, urine culture results, and local antibiotic resistance.

Non-drug therapy

All children are recommended to:

- increase fluid intake (unless contraindicated);
- regularly empty the bladder every 2-3 hours;
- avoid prolonged urine retention;
- maintain good intimate hygiene;

Limit irritating foods (hot spices, carbonated drinks, concentrated juices).

In cases of severe dysuria, heat therapy may be prescribed (in the absence of fever and hematuria), which helps reduce bladder spasms.

Antibacterial Therapy

Antibacterial drugs are the mainstay of treatment for bacterial cystitis.

Before starting treatment, it is advisable to obtain a urine sample for bacteriological examination, especially in the following cases:

- Recurrent cystitis;
- Atypical course;
- Age under 3 months;
- Lack of response to therapy within 48 hours.

Symptomatic therapy

Additionally, the following may be used:

- Antipyretics for fever;

- Analgesics for severe pain;

- Antispasmodics as indicated;

Herbal medicine as an adjunctive treatment (after the acute inflammation has subsided and taking into account the child's age).

Treatment of Recurrent Cystitis

Cystitis is considered recurrent if:

- Two or more episodes within 6 months;

- Three or more episodes within a year.

Treatment should include not only antibacterial therapy but also the elimination of risk factors:

- Correction of bladder dysfunction;

- Treatment of chronic constipation;

- Elimination of vesicoureteral reflux (if present);

- Treatment of foci of chronic infection;

Teaching the child proper urination habits.

Conclusion

Cystitis is one of the most common urinary tract infections in children and remains a pressing problem in modern pediatrics. The most common causative agent is *Escherichia coli*, but the role of other gram-negative microorganisms and multidrug-resistant strains is increasing. Early diagnosis, based on clinical assessment, laboratory confirmation of infection, and the rational use of instrumental diagnostic methods, allows for timely treatment and the prevention of complications.

Modern antibacterial therapy should be based on the results of urine culture, local antibiotic resistance, and international clinical guidelines. A comprehensive approach to the management of children with cystitis, including treatment of associated disorders and relapse prevention, helps reduce the frequency of recurrent infections and preserve urinary tract function in the long term.

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