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Pyelonephritis in Early Children

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Annotation: The relevance of the topic is due to the high prevalence and frequent recurrence of this pathology. In this regard, timely diagnosis of acute pyelonephritis and adequate treatment will improve the prognosis of the disease and reduce the frequency of chronicity of the process.

Keywords: children, microbial inflammatory kidney diseases, pyelonephritis, treatment.

Abstract: Among bacterial infections in children, urinary tract infection is the second most common after upper respiratory tract infection. The prevalence of urinary system infection is 10–18 cases per 1000 children: in the neonatal period - 1.4–2.4%, in preschool children - 0.5%, in the prepubertal period - 0.1%. In the structure of diseases of the urinary system, pyelonephritis ranks first, accounting for 60–65% of nephrological pathologies

Pyelonephritis - Pyelonephritis in children is a kidney disease in which the process affects the renal parenchyma. The main reason for the development of pathology is the entry of an infectious agent into the organ. Nephrologists, surgeons, urologists, pediatricians and other specialists assess symptoms, search for causes and treat pyelonephritis in children of different ages. Pyelonephritis is a nonspecific kidney disease caused by a bacterial infection. In most cases, the disease is provoked by Escherichia coli (up to 90% of cases), less often by staphylococcus or enterococcus. The pathology can affect either one or both kidneys at once. The peak incidence occurs in children under 5–6 years of age. This is due to the anatomical features of the structure and functioning of the genitourinary tract of young children. There is also some predisposition to the disease in girls (in boys, pyelonephritis is diagnosed 3 times less often). If the child's kidneys are damaged, it is imperative that they be shown to a qualified specialist. In the absence of adequate treatment, serious complications can occur: renal failure, kidney abscess, sepsis, bacterial shock, etc.

Etiology. The main reason for the development of pyelonephritis in children is the penetration of pathogenic microorganisms into the child's kidneys. Bacteria can enter the organ ascendingly in the

presence of diseases of the bladder or urethra, as well as hematogenously - when an infection is introduced through the bloodstream from the primary source of inflammation. The disease often occurs when there is a violation of the passage of urine associated with the physiological characteristics of the structure of the child's body or the presence of urological diseases.

Factors contributing to kidney inflammation:

frequent hypothermia of the body;

- the presence of inflammatory processes that reduce the child's immune defense (ARVI, influenza, chicken pox, etc.);
- presence of diabetes mellitus;
- other diabetes mellitus;
- hereditary predisposition;
- previous acute cystitis;
- urolithiasis;
- congenital kidney malformations

The risks are higher in children with congenital forms of bladder dysfunction and anatomical abnormalities in the development of the urinary organs. Insufficient personal hygiene can also cause infection to enter the kidneys, which is more common in girls.

Pathogenesis. There are ascending, hematogenous and lymphogenous routes of spread of urinary tract infection. During the neonatal period, the hematogenous route of infection predominates. Subsequently, the urinogenic (ascending) pathway comes first, especially in girls. This is facilitated by the short urethra and the relative proximity of the external opening connection of the urethra to the anus, which predisposes to greater contact with fecal flora and more frequent exposure to it into the paraurethral area. Pyelonephritis in children is a disease whose development is facilitated by numerous risk factors. Among the endogenous risk factors, the leading role in the development of urinary tract infection in children in the first 2 years of life belongs to anomalies in the development of the urinary tract, especially VUR.

With age, the role of exogenous risk factors increases, such as environmental distress (creating an increased load on the child's immune system and kidney function), poor nutrition, chronic infections in the family and in the child's environment, and stressful situations.The task of a pediatrician is not only to identify risk factors, but also to assess their significance in each specific situation and minimize their negative impact.

Classification. There are two main forms of childhood pyelonephritis: primary and secondary. They speak of the primary type when the inflammatory process originates in the kidneys itself and is independent. The secondary form of the disease is caused by other factors.

Secondary pyelonephritis, in turn, can be:

- obstructive, when inflammation manifests itself due to impaired fluid outflow due to mechanical blockage of the ducts or abnormalities in the development of the urinary tract;
- non-obstructive or dismetabolic, in which the pathological process becomes a consequence of metabolic disorders. According to the nature of the course, the classification of pyelonephritis in children implies the identification of two stages;
- infiltrative;
- sclerotic.

The duration of the disease can be acute or chronic.

- Acute pyelonephritis in children occurs with high fever, severe deterioration in health and other negative signs. Lasts up to 6 months.
- The chronic form of the pathology is accompanied by vague symptoms, but is characterized by frequent relapses. In some cases, chronic pyelonephritis occurs in a latent (hidden) form and can accompany the child throughout the rest of his life. The duration of this form of pathology is six months or more.

Also, pyelonephritis can be unilateral, when only one kidney is involved in the pathological process, and bilateral, when there is damage to the organ on both sides. Acute pyelonephritis is characterized by the transition of the active stage of the disease (fever, leukocyturia, bacteriuria) into a period of reverse development of symptoms with the development of complete clinical and laboratory remission with a duration of the inflammatory process in the kidneys of less than 6 months.

Chronic pyelonephritis is characterized by the persistence of symptoms of the disease for more than 6 months from its onset or the presence of at least two relapses during this period. The recurrent course is characterized by periods of exacerbation, occurring with the clinical picture of acute pyelonephritis (urinary and pain syndromes, symptoms of general intoxication), and remissions. The latent course is characterized only by urinary syndrome of varying severity.

Depending on the severity of the signs of the disease, exacerbation of chronic pyelonephritis, partial clinical and laboratory remission and complete clinical and laboratory remission can be distinguished. Exacerbation of chronic pyelonephritis is characterized by a combination of clinical symptoms and changes in blood and urine tests. Partial clinical and laboratory remission is characterized by the absence of clinical manifestations with persistent urinary syndrome. At the stage of complete clinical and laboratory remission, neither clinical nor laboratory signs of the disease are detected.

Clinic. The urinary system of newborns and young children is most susceptible to infection. This is due to anatomical and physiological characteristics and the immunodeficiency state characteristic of this age, since the synthesis of IgG is fully formed by 2-3, and IgA - only by 5-7 years of life. The clinical picture of pyelonephritis in newborns and young children is dominated by nonspecific symptoms of intoxication: fever, pallor or marbling of the skin, lethargy, loss of appetite, vomiting and regurgitation, insufficient weight gain or loss, diarrhea. Sometimes the only symptom of the disease in children At an early age there may be an increase in body temperature. The equivalent of dysuria in children of the first year of life may be anxiety or crying before, during and (or) after urination, redness of the face, tension in the suprapubic region, urination in small portions, weakness, intermittent urine stream. In older children, along with symptoms of intoxication, local symptoms are detected : pain in the abdomen and lumbar region, pain in the costovertebral angle with tapping and palpation, pain over the pubis and dysuria Acute pyelonephritis is characterized by a predominance of symptoms of a general infectious disease, which is subsequently joined by local symptoms. Chronic pyelonephritis in most children is a consequence of acute pyelonephritis.

The clinical manifestations of the disease directly depend on the degree of activity of the process and its course. An asymptomatic course is observed during the period of clinical and laboratory remission and during a latent course. With exacerbation of chronic pyelonephritis, the severity of the main syndromes and the general clinical picture resemble the manifestation of acute uncomplicated pyelonephritis. The most unpredictable is the latent course of pyelonephritis: the absence of clinical manifestations does not cause anxiety not only in patients and their parents, but also in doctors, and therefore pathogenetically based treatment is not carried out.

Diagnostics. If a child develops symptoms of acute or chronic pyelonephritis, parents should immediately consult a nephrologist. During the initial examination, the specialist will examine the young patient, collect the necessary anamnesis, and study the medical history. During the examination, the doctor clarifies the location of the pain syndrome and the presence of symptoms

accompanying the disease. After making a preliminary diagnosis, the patient is sent for laboratory and instrumental studies to clarify the characteristics of the course of the disease.

The list of additional diagnostics of pyelonephritis in children, depending on the indications and necessity, may include:

- general urine test - to determine the presence of an inflammatory process in the kidneys;
- urine culture for sterility - to detect the presence of infection in the urinary tract and determine its sensitivity to antibiotics;
- general blood test – to detect inflammation in the child's body and concomitant anemia;
- ultrasound examination – to determine the size of the kidney, the density of its parenchyma, the presence of deformation of the collecting system, etc.;

MRI or CT – to exclude possible pathological processes that could potentially provoke pyelonephritis. If there are complications, pediatric urologists must be involved in the diagnosis. In case of extensive infection, the help of a pediatrician or infectious disease specialist may be required. Metabolic disorders require examination by an endocrinologist. In case of upcoming surgical treatment, the child is examined by surgeons and anesthesiologists.

Treatment. Therapeutic measures for pyelonephritis should be aimed at eliminating the microbial inflammatory process in the kidneys and urinary tract, symptoms of intoxication, and normalization of abnormalities prevention of the development of sclerosis processes. Therapeutic tactics depend on age, degree of activity, duration of the disease, the nature of the course and etiology of the infectious process, and the presence of abnormalities in the development of the urinary system. The issue of hospitalization is decided depending on the severity of the child's condition, the risk of complications and the social conditions of the family.

Of great importance in the treatment of patients with pyelonephritis is compliance with the regimen and physical activity, depending on the severity of the patient's condition. Bed rest is necessary only in the acute period of the disease, with severe symptoms of intoxication. As the disappearance

In order to eliminate extrarenal symptoms of the disease, the motor mode gradually expands. Dietary restrictions are aimed at reducing the load on the tubular transport systems and correcting metabolic disorders.

In the active stage, table No. 5 according to Pevzner is prescribed without salt restriction, but with an increased drinking regime (50% more age norm). The basis of drug treatment of pyelonephritis is antibacterial therapy. There are three stages in the treatment of patients [9].

The first stage involves suppressing the active microbial inflammatory process using an etiological approach. Conventionally, this stage can be divided into 2 periods. The first period is aimed at eliminating the pathogen before obtaining urine culture results and includes the appointment of initial (empirical) antibacterial therapy, diuretic therapy (for non-obstructive variants), infusion-corrective therapy for severe endogenous intoxication syndrome and hemodynamic disorders.

The second period (etiotropic) consists of correcting antibacterial therapy taking into account the results of urine culture and determining the sensitivity of the microorganism to antibiotics. The second stage is aimed at atogenetic treatment against the background of subsiding of the process using antioxidant protection and immunocorrection.

The third stage involves anti-relapse treatment.

When choosing antibacterial drugs, the following rules must be taken into account:

- the drug must be active against the most common pathogens of urinary tract infections;
- the drug must not be nephrotoxic;
- the drug should create high concentrations at the site of inflammation;

- the drug must have a mainly bactericidal effect;

The duration of antibacterial therapy should be optimal, ensuring complete suppression of pathogen activity.

In acute pyelonephritis and exacerbation of chronic, antibacterial drugs are usually prescribed continuously for 4 weeks with changing the drug every 7-10-14 days or replacing them with a uroseptic. Initial antibiotic therapy is prescribed empirically, based on the most likely causative agents of infection (Table 2).

If there is no clinical and laboratory effect, the antibiotic must be changed after 2–3 days. For manifest severe and moderate-severe pyelonephritis, “stepped” antibacterial therapy is recommended. During the period of decreasing activity of pyelonephritis, preference is given to oral administration of drugs.

In severe septic conditions, microbial associations, multiresistance of microflora to antibiotics, when affecting intracellular microorganisms, as well as for

To expand the spectrum of antimicrobial action, in the absence of culture results, combined antibacterial therapy is used.

In the acute period of pyelonephritis with severe endogenous intoxication syndrome, infusion-corrective therapy is indicated.

After a course of antibacterial therapy, treatment should be continued with uroseptics. Nalidixic acid preparations (nevigramon, negram) are prescribed to children over 2 years of age. These drugs have a bacteriostatic and bactericidal effect, depending on the dose, against gram-negative flora.

The drugs cannot be combined with nitrofurans due to their antagonistic effect.

Empirical initial antibacterial therapy for pyelonephritis

Manifest course of pyelonephritis, severe and moderate to severe (parenteral administration of drugs - i.v., i.m.). Possible step therapy	**"Protected" penicillins:** amoxiclav, augmentin, unasin, timentin **2nd generation cephalosporins:** cefuroxime, cefamandole **3rd generation cephalosporins:** cefotaxime, cefoperazone, ceftazidime, ceftriaxone, **4th generation cephalosporins:** cefepime **Aminoglycosides:** gentamicin, netromycin, amikacin **Carbapenems:** imipenem, meropenem
Period of subsidence of activity (mainly oral route of administration)	**"Protected" penicillins:** amoxiclav, augmentin, unasin, timentin, **2nd generation cephalosporins:** cefuroxime, axetil, cefaclor **3rd generation cephalosporins:** ceftibuten **Nitrofuran drugs:**furadonin, furagin, furamag **Drugs from the group of non-fluorinated quinolones:**pipemi dinic acid, nalidixic acid, 8-hydroxyquinoline

Nitrofuran drugs (furadonin, furagin) and 8-hydroxyquinoline derivatives (nitroxoline, 5-NOK)

have a broad bactericidal effect. It is prescribed to children in exceptional cases - when other uroseptics are ineffective. Pathogenetic therapy includes non-steroidal anti-inflammatory drugs, antioxidants, immunocorrective and anti-sclerotic therapy.A combination with non-steroidal anti-inflammatory drugs is used to suppress inflammatory activity and increase effect of antibacterial therapy. The course of treatment is 10–14 days.

The complex therapy for pyelonephritis includes drugs with antioxidant and antiradical activity. Among the drugs that improve renal microcirculation, trental, chimes, aminophylline, and cinnarizine are prescribed. Immunocorrective therapy for pyelonephritis is prescribed after consultation with an immunologist strictly according to indications.

Immunal, levamisole, licopid, reaferon, viferon, etc. are used as immunotropic agents for pyelonephritis and urinary tract infections in children. If patients have signs of sclerosis of the renal parenchyma, it is necessary to include in the treatment complex drugs with an anti-sclerotic effect (delagil, plaquenil) in a course of 4 –6 weeks.Anti-relapse therapy for pyelonephritis is carried out in an outpatient setting and involves long-term treatmentantibacterial drugs in small doses. Most often in pediatric practice, nitroxoline, 5-NOK, furamag, and “protected” penicillins are prescribed as anti-relapse therapy.

The duration of anti-relapse therapy is for acute pyelonephritis - 3-6 months, for chronic pyelonephritis - from 6 months to 1 year. During the period of remission in an outpatient setting, along with anti-relapse therapy, herbal medicine is prescribed, which helps improve urine passage, reduce inflammatory manifestations, improve blood supply to the kidneys.

In recent years, the galenic drug “Canephron” has appeared, which includes centaury herb, lovage root and rosemary leaves. Physiotherapeutic methods of treatment (EVT, ultrasound, ozokerite, paraffin applications, electrophoresis of a 1% solution of furadonin, furagin on the kidney area, therapeutic baths, mineral water of low mineralization) are used during the period of subsidence of activity process, in the stage of clinical and laboratory remission, to prevent relapses.

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