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ETIOLOGICAL, CLINICAL FEATURES OF SECONDARY PYELONEPHRITIS IN CHILDREN

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ABSTRACT

The high frequency of pyelonephritis, as well as its tendency to be chronic and progressive, gives the problem of timely diagnosis and treatment of pyelonephritis a particular urgency. Among the factors predisposing to secondary pyelonephritis, the abnormalities of the development of the urinary system that cause disturbances in urodynamics have always been given importance.

The article presents the results of the study of the etiological, clinical features of secondary pyelonephritis in children, depending on the type of abnormality of the development of the kidneys and urinary tract. 150 children with microbial-inflammatory diseases of the urinary system were examined. As a result of the study, it was revealed that pyelonephritis dominates the structure of microbial-inflammatory diseases of the urinary system. Among the abnormalities of kidney and urinary tract development in this group of patients, the following were identified: vesicoureteral reflux, neurogenic dysfunction of the bladder, kidney doubling, kidney dystopia, nephroptosis, kidney hypoplasia, renal agenesis, renal dysplasia. According to our data, the secondary pyelonephritis in the structure of secondary chronic pyelonephritis is secondary to vesicoureteral reflux (25.5%) and neurogenic bladder dysfunction (52.2%). In the study of the complications of vesicoureteral reflux with chronic pyelonephritis secondary revealed that the major complication is nephropathy reflux with the development of chronic renal insufficiency, which was observed in 12.5% of cases. Despite the fact that vesicoureteral reflux is more common in girls, the more severe course of the disease was noted in boys and, consequently, reflux-nephropathy often developed in boys. Reflux-nephropathy does not have a typical clinical picture, is characterized by a steadily progressing course with the development of nephrosclerosis.

It has been revealed that pyelonephritis more and more clearly appears as a secondary process. According to our data, in the structure of secondary chronic pyelonephritis, the greatest percentage is secondary pyelonephritis against the background of neurogenic dysfunction of the bladder and against a background of vesicoureteral reflux. In this case, children more often recorded neurogenic dysfunction of the bladder in a hyporeflexive type. And among children with vesicoureteral reflux, the prevalence of vesicoureteral reflux on the left was more often noted. Recently, the concept of obstruction of the urinary tract has undergone significant changes and has become more capacious.

Keywords: children, infection of the urinary system, secondary pyelonephritis, malformations.

Introduction

In recent decades, there has been an unfavorable upward trend in the child population of recurrent pyelonephritis, which is formed against the background of congenital malformations of the urinary system [7]. The average annual rate of increase in the incidence of urinary tract infection is 6.1% [1, 5]. The severity of the problem is due to a high incidence of pathogenetic factors of infection of the urinary system (reflux-uropathy, congenital malformations of the urinary system with violation of urodynamics, a combination of vesicoureteral reflux and neurogenic bladder dysfunction, urolithiasis, hemolytic-uremic syndrome, intestinal microbiocenosis, etc.), and also a feature of uropathogenic properties of pathogens, their ability to persistence, high antibiotic resistance [1]. The high frequency of pyelonephritis, as well as its tendency to be chronic and progressive, gives the problem of timely diagnosis and treatment of pyelonephritis a particular urgency. Among the factors predisposing to secondary pyelonephritis, the abnormalities of the development of the urinary system that cause disturbances in urodynamics have always been given importance. In the structure of all congenital malformations, the anomalies of the genitourinary system occupy the third

place. There are more than 50 diseases of the urinary system as hereditary and congenital, as well as acquired, both primary and secondary, which result in the development of chronic renal failure. But the most common cause of chronic renal failure in children is congenital and hereditary diseases of the kidneys and urinary tract. Among the risk factors for the development of microbial-inflammatory kidney diseases in children, obstruction of the urinary tract is one of the leading places [2]. Normal urodynamics is one of the factors that prevent the spread of microorganisms and their adhesion on the surface of uroepithelium.

The consequences of kidney damage in childhood are so significant that timely detection of them is a problem not only medical but also social [7]. The social significance of the problem is reinforced by the fact that the treatment of these patients at all stages of the development of the pathological process often becomes expensive, including through the need for repeated outpatient visits to the doctor and hospitalizations, and they often experience a significant deterioration in the quality of life [8].

The number of children with recurrent course of various variants of infections of the urinary system is constantly increasing, making it necessary to search

for more effective ways of treating renal microbial-inflammatory infection on the basis of modern principles of preventive, clinical and rehabilitation nephrology [1]. The study of the infectious and inflammatory pathology of the organs of the urinary system is inextricably linked with the definition of its etiology [5, 6]. For many years, the main causative agent of pyelonephritis in children is *E.coli* (inoculation from urine ranges from 60 to 87.3% [1], which has a large number of virulence factors [1, 2, 3, 8]. However, over the past decade, a change the structure of the causative agents of urinary system infections in children due to an increase in the frequency of other representatives of the *Enterobacteriaceae* family (*Klebsiella*, *Proteus*, *Enterobacter*), as well as Gram-positive coccal flora and aerobic Gram-negative rods [3, 6], which indicates the need for a regular microbiologic monitoring of uropneoprase in children with urinary system infections in the regions of the Russian Federation [4].

The aim of our study was to study the etiological, clinical features of secondary pyelonephritis in children, depending on the type of abnormality of the development of the kidneys and urinary tract.

Materials and methods of research

150 children with microbial-inflammatory diseases of the urinary system, hos-

pitalized in the nephrologic and urological departments of the Pediatric Center of the National Center of Medicine from 2010 to 2017, 85 girls, 65 boys were examined. The diagnosis of pyelonephritis was verified in accordance with the classification proposed by M. Studenikin (1982). All patients were assessed the degree of activity of the pathological process (severity of intoxication, pain, dysuric syndromes), the functional state of the kidneys, bacteriological examination of urine, instrumental methods of studying the kidneys and urinary tract (ultrasound, intravenous urography, cystography).

Results and discussion

In the structure of microbial-inflammatory diseases of the urinary system acute pyelonephritis was verified in 83 (55.3%) patients, in 60 (40.0%) children pyelonephritis was secondary, and in 7 (4.7%) children with chronic pyelonephritis of structural and functional disorders of the urinary system at the time of the examination not found.

Among the abnormalities of kidney and urinary tract development in the studied patients, the following were identified: vesicoureteral reflux, neurogenic dysfunction of the bladder, kidney doubling, kidney dystopia, nephroptosis, kidney hypoplasia, renal agenesis, renal dysplasia. According to our data, the secondary pyelonephritis often occurred on the background of vesicoureteral reflux (25.5%) and neurogenic bladder dysfunction (52.2%). These data coincide with the literature data, which confirm the emergence of secondary pyelonephritis by infection of the urinary system against a background of urodynamics disturbance caused most often by vesicoureteral reflux and neurogenic dysfunction of the bladder.

We have identified the clinical features of secondary pyelonephritis in the background of various abnormalities of kidney and urinary tract development.

Neurogenic bladder dysfunction (NBD) is a violation of reservoir and evacuation functions of the bladder, which develop due to damage to the mechanisms of regulation of urination of various geneses and at different levels. NBD refers to functional abnormalities of kidney development. In this group of patients there were 31 children (52.2%), and 20 (64.5%) children with NBD in a hyporeflexive type and 11 (35.5%) - in a hyperreflex type. The combination of hyperreflex NBD with vesicoureteral reflux was 11.8%.

Bladder ureter reflux (BUR) is one of the most common diseases of the lower urinary tract in children. BUR met in 15

children (25%), at the age of 1 year, the disease showed up in 6.3% of cases. Right BUR was detected in 5 children (33.3%), on the left - in 10 children (66.7%). Analysis of the age structure of patients showed that the proportion of children under 5 years is 33.3%, from 6-9 years - 40.7%, from 10-13 years - 26.0%. At analyzing the distribution of children by sex, taking into account age groups, it was found that the BUR occurs with the same frequency (33%) in boys and girls from 2 to 5 years; in children 6-9 years: girls - 47%, boys - 33%; from 10-13 years: girls - 20%, boys - 33%.

Development of BUR in 62.5% of children was preceded by an unfavorable course of the prenatal period. In 40.6% of cases in their mothers there were complications of pregnancy in the form of anemia, gestosis, threat of interruption, etc., in 12.5% of cases, pregnancy was accompanied by extragenital pathology, in 9.4% of cases there was a combination of complications of pregnancy and extragenital pathology. In addition, in 8% of cases, BUR was registered in mothers, and only in 37.5% there was a smooth course of pregnancy.

The main clinical manifestations in children under 1 year were severe symptoms of intoxication with high hyperthermia, increased excitability, and lack of body weight. The clinical picture in older children was characterized by periodic temperature rises, accompanied by pallor of the skin, lethargy, headache. Pain in the abdomen was aching, usually in the lumbar, subcostal area or along the ureter.

At laboratory-instrumental diagnostics of vesicoureteral reflux in children the following was revealed. As a rule, a symptomatic complex of urinary infection was detected, characterized by leucocyturia, bacteriuria, hypostenuria, nocturia, increased ESR. In the case of the formation of focal nephrosclerosis, a tendency to hypo- and isostenuria, polyuria was added, persistent proteinuria appeared. Ultrasound diagnosis tentatively determined the degree of dilatation of the cavity system, the size of the kidneys, the thickness of the parenchyma, variants of its deformation. Intravenous urography, not being a diagnostic test for reflux, nevertheless allowed to suspect the presence of pathological processes in the lower parts of the urinary tract. So, for the presence of BUR, hypotension of the ureters can indicate, especially if it is of a one-sided nature, dilatation of the cavity system and the distal ureter. Mictorial cystography is the main method of reflux diagnostics, which makes it possible to

reveal not only its presence, but also the degree of expression.

At examining children with BUR, the following abnormalities of the development of the organs of the urinary system were revealed: dysplasia, hypoplasia, kidneys doubling in 36% of children; neurogenic dysfunction of the bladder - in 24%, of them hyporeflexive type - in 14%, in the hyperreflexive type - in 10% of children. Double-sided BUR was noted in 56.2% of cases, unilateral - in 43.8%. Second-degree BUR occurred in 18.8% of cases, grade III - in 71.9%, IV degree - in 9.4% of cases.

In accordance with the tasks set, we analyzed the effectiveness of treatment in children with BUR against chronic secondary pyelonephritis. Of all hospitalized children, 56.2% of patients received conservative treatment. Great attention was paid to conservative treatment of antibiotic therapy, physiotherapy. In assessing the efficacy of conservative therapy, it was noted that in boys with first-degree BUR a good result was achieved in 72% of cases, with II degree of BUR in 57%; in girls with first degree BUR - in 67%, with II degree of BUR - in 64%. Surgical treatment was performed in 43.8% of the children.

At studying the complications of BUR against the background of chronic secondary pyelonephritis, it was found that the main complication is reflux-nephropathy with the development of chronic renal failure, which was noted in 12.5% of cases. Despite the fact that BUR is more common in girls, the more severe course of the disease was observed in boys and, consequently, reflux-nephropathy more often developed in boys. Reflux-nephropathy does not have a typical clinical picture, is characterized by a steadily progressing course both in the presence of BUR and after its regression. Factors contributing to the formation and increase in the degree of nephrosclerosis include long-persistent BUR, the recurring course of infection of the urinary system, neurogenic dysfunction of the bladder, dysplasia of the canvas tissue.

Doubling of the kidneys is one of the most common malformations, which is transmitted by an autosomal recessive type of inheritance. Among the investigated patients, kidneys were doubled in 6 children (10%). Doubling of the left kidney was determined in 3 children (50%), the right kidney in 2 children (33.3%), incomplete doubling of both kidneys in 1 child (16.7%). In 2 children (33.3%), the doubled kidney was complicated by hydro-nephrosis, in 1 child (16.7%) - BUR. The main clinical symptoms were abdominal

pain - in 66.6% of cases, microhematuria - in 47.3% of cases, arterial hypertension - in 3.3% of cases.

Among the anomalies of the situation dystopia of the kidneys is the most common pathology. Dystopic kidneys are retained in their position due to abnormally developed vessels that provide blood circulation in the early stages of embryonic development or insufficient growth of the ureter in length. With kidney dystopia there were 4 children (6.7%). The leading symptom in kidney dystopia in children was pain when the position of the body changed. The most pronounced pain syndrome was detected in a child with pelvic dystopia of the kidneys.

Nephroptosis, excessive mobility of the kidneys, was determined in 6 children (10%). Among them, nephroptosis of the left kidney was detected in 1 child (16.7%), nephroptosis of the right kidney - in 5 children (83.3%). All children clinically detected abdominal pain and in 60% of cases - dyspepsia.

In 2 (3.3%) children, normonephronic hypoplasia of the kidneys was detected. There were no special clinical manifestations in this pathology in children.

In our group of patients there were 8 children (13.3%) with kidney agenesis unilateral (KAU). The cause of KAU is most often the failure of the inductive interaction of the ureteral outgrowth and the nephrogenic strand, which causes degeneration and resorption of the structure of the latter. Left kidney anogenesis was detected in 2 children (25%), right - in 6 (75%). One child had hypertension.

Kidney dysplasia was detected in 3 children (5%), all children had severe urinary syndrome, which was characterized by massive leukocyturia, mild proteinuria and 2 children with hematuria. One child had a recurrent abdominal syndrome.

In a bacteriological study of urine conducted against the background of antibacterial therapy, microflora was isolated in 28% of cases. In the development of the microbial-inflammatory process of the urinary system in 90.3% of cases there was a monoinfection, in 9.7% of cases the association of uropathogens - *E. coli* + *Str. faecium*, *Proteus mirabilis* + *Str. epidermidis*, *Citrobacter freundii* + *Klebsiella oxytoca*. The microbial inflammatory process was mainly caused by *E. coli* (42%) and *Klebsiella pneumoniae* (16.1%). Antibiotic therapy was carried out taking into account the sensitivity of antibiotics and uroseptics.

The conclusion

Thus, pyelonephritis appears more and more clearly as a secondary process. According to our data, in the structure of secondary chronic pyelonephritis, the greatest percentage is secondary pyelonephritis against the background of neurogenic dysfunction of the bladder and vesicoureteral reflux. In this case, children more often recorded neurogenic dysfunction of the bladder in a hyporeflexive type. And among children with vesicoureteral reflux, the prevalence of BUR on the left was more often noted. Recently, the concept of obstruction of the urinary tract has undergone significant changes and has become more capacious. It unites now not only representations of mechanical obstacles to the flow of urine, but also dynamic, or, as they are called, "functional" disorders of the urinary tract, their hyper- or hypokinesia, dystonia, which also violate the normal passage of urine. Disorders of bladder emptying with neurogenic dysfunctions are accompanied by urodynamic disorders in both lower and upper urinary tract, which explains the rather high occurrence of pyelonephritis in children with neurogenic bladder dysfunction.

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