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MODERN VIEWS ON ISCHEMIC KIDNEY DAMAGE IN NEWBORNS

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Abstract:

Ischemic nephropathy is one of the most severe and frequent kidney diseases in newborns in critical condition. The extreme manifestation of the disease is acute renal failure. However, clinical manifestations of ischemic nephropathy are masked by the critical condition of the child and are often diagnosed only with the maximum severity, while the outcome of the disease directly depends on the timeliness and adequacy of therapy [1, 2].

Keywords:

Ischemic nephropathy is one of the most severe and frequent kidney diseases in newborns in critical condition. The extreme manifestation of the disease is acute renal failure. However, clinical manifestations of ischemic nephropathy are masked by the critical condition of the child and are often diagnosed only with the maximum severity, while the outcome of the disease directly depends on the timeliness and adequacy of therapy [1, 2].

A universal response to damage to renal tissue is considered to be an increase in the activity of nephrothelial enzymes in the urine. The activity of cholinesterase (HE) in urine reflects the state of the glomerular apparatus of the kidneys. Based on the study of the activity of this enzyme, it is possible to judge a violation of the permeability of the glomerular filter [5, 6].

Due to the increase in perinatal pathology in children, the expansion of intensive care, there is an increase in the number of nephropathies in newborns and young children [5]. In the structure of renal pathology in newborns, ischemic nephropathy (IN) deserves special attention, characterized by ischemic changes in the glomeruli and tubules of the kidneys, manifested by a significant decrease in the glomerular filtration rate, pronounced azotemia and a decrease in sodium and water reabsorption [1]. Taking into account the absence of noticeable signs of nephropathy in newborns during the first day of life, due to their non-specificity, veiled anatomical and physiological features of the kidneys, the severity of neurological symptoms, lesions of the respiratory system, cardiovascular system, it is necessary to search for new diagnostic tests indicating the development of a pathological process in the renal tissue. Hyperfermenturia is considered a universal response to damage to renal tissue. The activity of nephrothelium enzymes in urine makes it possible to assess the degree of damage to the structural and functional elements of the nephron and to clarify the predominant localization of the process [4]. The activity of cholinesterase (HE) in urine reflects the state of the glomerular apparatus of the kidneys, based on the study of the activity of this enzyme, it is possible to judge a violation of the permeability of the glomerular filter [2,4,7,8]. In the kidney, alkaline phosphatase (alkaline phosphatase) is located in the cortical layer and is very firmly fixed on the matrix of the membranes of the brush border of the nephroepithelium. The activity of alkaline phosphatase in urine increases with damage to the proximal convoluted tubules of the kidneys [3,4,6,7,8]. β-glucuronidase (β-GL) is approximately equally distributed between the cerebral and cortical substance of the kidneys, localized mainly in the cells of the distal tubules [4,8].

No pathological stress condition affecting the fetus and newborn leaves the kidneys intact [6, 7]. The growth of diseases of the urinary system in newborns in recent years has been associated with an increase in the frequency of congenital and hereditary forms due to a violation of the condition in the mother-placenta-fetus system. There is no doubt that kidney pathology in pregnant women is not indifferent to the fetus [1,4, 19]. In newborns born to women with azotemia, mortality is 5 times higher than in children from healthy women [19]. The presence of gestational pyelonephritis, as well as exacerbation of chronic pyelonephritis, is accompanied by inflammatory changes in the placenta, the development of intrauterine infection and manifestations of endogenous intoxication with hypoxic and toxic damage to the fetal kidneys [15, 19]. In addition, it is unsafe for the unborn child to prescribe antibiotics and a number of other medicines and polypragmasia in the treatment of pregnant women [16, 20]. It was found that the frequency of nephropathies in children from families with kidney pathology is 20 times higher than in the general population. Hence, the family approach to early detection of kidney diseases in children is important [13]. The nonspecific nature of the clinical symptoms of perinatal nephropathies, the latent onset

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and torpid course of the pathological process, low information content, technical complexity, and invasiveness of many existing methods of studying kidney function in the newborn period complicate the timely diagnosis of perinatal renal pathology and contribute to the chronization of the process, up to the development of chronic renal failure already in infancy [8, 9, 14, 17]. In this regard, studies of kidney function in newborns born to mothers with kidney pathology using simple and highly informative diagnostic technologies are of practical importance and scientific value. One of the promising methods for assessing the functional state of the kidneys is the method of recording chemiluminescence (CL) of urine, reflecting the state of free radical oxidation in the kidneys [11]. It has been shown that when iron ions are added to urine, CL occurs, the nature of which changes with a violation of the functional state of the kidneys [10].

In children who have suffered severe hypoxia, have concomitant diseases, and received massive therapy, the frequency of kidney damage increases, and in newborns who were treated in the intensive care unit, kidney pathology develops in about 1/3 of cases [3]. Acute renal failure in newborns is diagnosed in 6-58% of cases [4-6]. At the same time, latent forms of nephropathies associated with renal dysembriogenesis have become more common in newborn children [7, 8]. A violation of embryogenesis can manifest itself not only at an early age, therefore, in recent years, scientists have begun to study the causes leading to a violation of embryonic, fetal and histogenesis of the kidneys [9, 10]. Risk factors for the development of pathology of the urinary system in newborns include, in addition to congenital and hereditary diseases, extragenital pathology in the mother, intrauterine infections, complicated pregnancy (ARVI, gestosis and the threat of termination, chronic fetal hypoxia, polyhydramnios), drug load, etc. [11-13]. In all of the above conditions, chronic fetoplacental insufficiency occurs, in which the main pathogenetic factor causing fetal kidney damage is chronic intrauterine hypoxia; at the same time, kidney histogenesis is particularly affected [4, 11, 14]. Violation of histogenesis may be manifested by kidney malformations (in 1 / 5 of newborns) and other reliable criteria for morphofunctional immaturity of the kidneys: a decrease in organ mass, asynchronous development of vascular and epithelial components of the nephron, impaired differentiation of nephrogenic tissue with persistence of embryonic structures — organ dysplasia [8, 10, 15, 16]. It is obvious that a significant number of malformations of the kidneys and urinary organs remain undiagnosed at birth, and with further growth and development of the child (with an increase in metabolic load), severe pathology manifests itself. Taking into account the possibility of an evolutionary reserve for the maturation of morphological structures, with timely prediction of the formation of pathology (immediately after the birth of a child) and the use of modern medical technologies, it is possible to create conditions for the maturation of nephrogenic tissue, which means preventing the development of a serious disease. The determination of the prognosis will, among other things, determine the scope of therapeutic measures, taking into account the exclusion of the appointment of nephrotoxic drugs that delay the maturation of morphological structures. In this regard, new diagnostic techniques are needed that allow for prenatal diagnostics and identify risk groups for the development of renal pathology among newborns. Currently, researchers are building a hypothesis about the possibility of kidney damage in the fetus and newborn, assessing individual risk factors [17-19]. Some authors of methods of early diagnosis of kidney pathology in newborns suggest assessing the clinical manifestations of damage [11, 20]. At the same time, a direct dependence of the severity of the clinical manifestation of this pathology on the severity of chronic hypoxia or acute asphyxia is indicated [11]. Early prediction of emerging kidney pathology at the stage of pre-disease (rather than clinical evaluation of an already damaged kidney) is more significant.

According to various population studies, diseases of the urinary system organs in children are quite widespread (from 29 to 40 per 1000 children), tend to grow and tend to progress [1-4]. According to most authors, many kidney diseases have their origins in the antenatal period [4-6]. However, a significant number of antenatal renal diseases remain undiagnosed in the neonatal period, since they are usually clinically manifested in early, late ontogenesis or in adults [6-8]. According to the existing literature data, the frequency of acute and chronic renal failure is increasing all over the world, including already in infancy [8, 9], the main causes of which are obstructive uropathies progressing against the background of structural dysembriogenesis, recurrent pyelonephritis, hereditary kidney pathology [10-13]. Acute renal failure is registered on average in 16% of newborns with nephropathies [7, 9]. Risk factors for its development in newborns are artificial lung ventilation, hypoxia, ischemia, generalized infection, including viral, hypovolemia, disseminated intravascular coagulation syndrome and renal vascular thrombosis, administration of nephrotoxic drugs, contrast agents and congenital anomalies of the development of the urinary system [13-15]. In most cases, acute renal failure in newborns proceeds according to the neoliguric type, and in the absence of proper laboratory control, this condition may remain

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undiagnosed [9, 12, 15]. No pathological condition of the perinatal and neonatal periods leaves the kidneys intact as the main eliminating organ [3, 4, 6, 7, etc.]. Considering the variety of adverse factors affecting the body of the fetus and newborn, researchers note that a significant role belongs to acute and chronic hypoxia, which disrupts the formation and maturation of structural units kidneys, causing hypoperfusion of tissues up to the development of ischemic lesions and infarcts [23-25]. According to K. Streitman et al., severe perinatal hypoxia causes multiple organ failure with combined damage to the heart, liver and kidneys [26]. According to O.L. Chugunova, with a mild degree of hypoxic ischemic kidney damage, newborns develop hypoxic nephropathy, and with more pronounced effects — interstitial nephritis and renal infarction, often accompanied by acute renal failure [22].

CONCLUSION

The causes of diseases of the urinary system in newborns and young children are quite numerous and diverse. Most authors associate the increase in perinatal nephropathies with an increase in the frequency of congenital and hereditary forms, deterioration of reproductive health of women of childbearing age, increased complications of pregnancy and childbirth, perinatal pathology, including specific intrauterine and postnatal infections. In addition, successes in the provision of resuscitation care to newborns play a role, the toxic and allergic effects of drugs, the deterioration of the environmental background, as well as the improvement of the diagnosis of these conditions due to the directed study of the problem are important.

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