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EVALUATION OF THE FUNCTIONAL STATE OF THE KIDNEYS OF NEWBORNS BORN TO MOTHERS WITH OPG GESTOSIS

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Abstract

40 newborns were examined, the functional state of the kidneys was assessed depending on the presence of OPG gestosis in pregnant women. It was revealed that all newborns have a decrease in diuresis, a decrease in the osmotic concentration of urine, which increases by the end of the first week of life, but does not reach the indicators of healthy children, while the most pronounced changes are observed in the group of children born to mothers with OPG gestosis, and are accompanied by azotemia, which is associated with catabolic processes in the body and reduced renal excretion of nitrogenous products.

Keywords: Newborns, kidneys, OPG gestosis in pregnancy.

INTRODUCTION

Relevance of the Problem

OPG gestosis ranks 2-3 in the structure of causes of perinatal morbidity in mortality (1.5), which is due to chronic hypoxia, intrauterine growth retardation of the fetus (1-4). This is a complication of pregnancy, which is manifested by fetoplacental insufficiency, metabolic disorders, vasoconstriction, activation of the coagulation cascade, endothelial dysfunction and hemostasis disorders (7). Despite significant achievements in perinatology in recent years, the incidence of preeclampsia is from 16 to 22% of all pregnancies and does not tend to decrease. In developed countries, OPG gestosis is the second direct cause of ante- and postnatal mortality, affecting perinatal mortality 911-17). The leading role in the structure of perinatal mortality in gestosis belongs to fetal asphyxia. Along with disorders in the respiratory system, the kidneys, which after birth replace the placenta as the main organ of homeostasis, suffer from asphyxia first of all (18-22). Renal blood flow of the fetus is only 2-3% of cardiac output compared to 15-185 in adults. Glomeruli are fully formed only by 34 weeks of birth and its level, as in an adult, is achieved only by the age of one year (5-11). Thus, the study of kidney function in newborns against the background of maternal gestosis is an urgent problem. In this regard, we assessed the functional capabilities of the kidneys of newborns born to mothers with OPG gestosis.

Material and Methods of the Study

A comprehensive clinical, laboratory and instrumental examination of 40 newborns born at gestation periods from 32 to 36 weeks was conducted. All examined newborns were divided into the following groups: Group 1 - 20 newborns born to mothers with gestosis, Group 2 - 20 current

261 | Page



ISSN (E): 2938-3765

pregnancy and whose delivery was physiological. The body weight of children in Group 1 at birth was 2070.20 ± 144.70 g, and in the second it was slightly higher (2237.30 ± 150.56 g). The exclusion criteria were: gestational age less than 32 weeks, congenital malformations, including those of the urinary system, manifest forms of intrauterine infections and purulent-septic diseases. The severity of gestosis in pregnant women was assessed using the Goecke scale modified by G.M. Savelyeva. In this case, 17 out of 20 women had moderate gestosis and 3 had severe gestosis. For biochemical studies, venous blood was collected from the umbilical vein immediately after birth and from the subcutaneous veins of the head. Urine was collected for 6-8 hours using the Apcria method (1989). Nitrogen homeostasis was assessed by the level of urea and creatinine in the blood and urine using a Mindray MR-96A biochemical analyzer. Osmotic activity is determined using an osmometer, the operating principle of which is based on determining the cryoscopic constant of a given solution and comparing it with the cryoscopic constant of water. It is important to note that the volume of the liquid being studied is only 50-100 µl.

Results of the Study:

A comparative analysis revealed that only 5% (1) of children in the main group and 15% (3) in group 2 were born without asphyxia, i.e. with an Apgar score of 8 or higher, thus, significantly more premature babies were born in a state of asphyxia from women with gestosis (p < 0.01), severe asphyxia at birth was observed significantly more often in children in the main group (40% compared to group 2 255, p < 0.01). Thus, the obtained results indicate a direct dependence of the functional state of premature infants in the first minute of life not only on the morpho-functional state of newborns in the first minute of life, not only on morpho-functional immaturity, but also on the presence of preeclampsia in the mother. According to the data obtained, pathology of the respiratory and central nervous system (CNS) prevailed in premature infants of both groups. The incidence of respiratory distress syndrome (RDS) decreased with increasing gestational age. Thus, the degree of respiratory failure was assessed using the Silverman scale. Respiratory failure (RF) of the 1st degree was detected in 30% of newborns in the main group and 55% in the 2nd group, respectively. The second degree of respiratory failure was noted in the main group in 60% of newborns in group 1, in group 2 - in 45%. The third degree of respiratory failure was determined in 2 9 -10% of premature infants in the main group, while in children of the second group these cases were not registered. Thus, severe respiratory failure was more often noted in premature infants of women with gestosis (p < 0.01).

When studying the general reaction of the newborn's body to identify signs of kidney damage, it was found that the edema syndrome significantly predvaritelya in children born to children born to mothers with OPG gestosis. Thus, edema syndrome was observed in 60% of children in group 1, when identifying signs of edema syndrome in the group of children born to mothers with a physiological pregnancy, only isolated cases were identified, while the edema syndrome was represented by 1 (mild severity). Thus, edema syndrome in newborns was conventionally divided into edema of the skin, subcutaneous fat, eyelids, pubis, lethargy, hypotension, hyporeflexia, unstable thermoregulation, respiratory failure. With grade 2 edema syndrome, widespread edema was noted on the face, chest, abdomen, limbs, this contingent of children amounted to 25% of





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children in group 2. At grade 3, massive edema was observed, especially on the dorsal surface of the hands and feet; premature babies with these symptoms were found in 255 cases.

When studying the water-excreting function of the kidneys, it was found that the first urination in premature infants born from a physiologically progressing pregnancy was on average after 17.3 hours and the amount of urine excreted was 1.06 ± 0.04 ml / kg / hour, during the first day, while, despite the fact that the rate of increase in diuresis during the first seven days was higher than in full-term children, daily diuresis in this group of children on the 6-7th day remained reduced and was 1.48 ± 0.07 ml / kg / hour. In 55% of children born to mothers with gestosis, especially those who suffered severe asphyxia, the first urination occurred in the delivery room, and the next one on average after 19 hours. Daily diversis throughout the week was reduced 0.98 ± 0.08 ml / kg / hour. By 3-4 days, 25% of newborns in group 1 had a decrease in diuresis to 0.36 ml / kg / h. Thus, it was found that all premature infants born to mothers with OPG gestosis had impaired glomerular filtration, this fact was especially pronounced in children who suffered severe asphyxia, due to renal vasoconstriction and hypoperfusion, oliguria developed by 3-4 days. The osmolar concentration of plasma in premature infants of group 2 was on average $273.93 \pm 0.81 \text{ mosm} / 1$, while in premature infants born to mothers with OPG gestosis it was determined in the range from $210.33 \pm 1.7 \text{ mosm} / 1 \text{ to } 273 \pm 1.8 \text{ mosm} / 1 \text{ and on average amounted to } 264.75 \pm 0.66 \text{ mosm} / 1.$ Thus, in premature infants, a decrease in the ability of the kidneys to form osmotically concentrated urine was detected, the impairment of which was especially pronounced in premature infants born to mothers with OPG gestosis.

When determining the urine osmolarity, it was found that the urine remained hypotonic throughout the first week of life in children of the main group (on average $284.56 \pm 10.5 \text{ mosm} / 1$). In premature infants born to healthy mothers, the formation of the water-excreting function of the kidneys occurred more intensively, the urine was hypotonic only on the first day (296.31 \pm 9.7 mosm / l), and by the end of the early neonatal period, the osmolar concentration of urine was equal to $398.52 \pm 10.1 \text{ mosm} / 1$. A direct correlation was established between diuresis and urine osmolarity (r = 0.78). In the first week of life, a wide range of nitrogen-containing products from 0.034 to 1.23 mmol / l was revealed in newborns of all studied groups. In the 2nd group, an increase was noted in their nitrogen excretion in premature infants who were born from a physiologically proceeding pregnancy; in the first day it was small (creatinine 0.048±0.002 mmol/l, urea 4.13±0.20 mmol/l), which, apparently, is an adaptive mechanism, because in the first days of life the child is in conditions of reduced protein intake, as well as the breakdown and absorption of food. Therefore, the excretion of nitrogen-containing products was consistent with the level of tissue catabolism (urine creatinine 0.21±0.01 mmol/l; urine urea 13.45±0.49 mmol/l). With an increase in diuresis in full-term newborns, the level of nitrogen excretion also increased. We established a direct correlation between diures is and the concentration of urea in the urine (r=0.512) of newborns in group 1.

In the group of premature infants, the concentration of creatinine and urea was significantly higher than in the group of children born to women with physiological pregnancy throughout the early neonatal period (creatinine 0.077 ± 0.022 mmol/l, p<0.001; urea 5.31 ± 0.15 mmol/l, p<0.05). Accordingly, the concentration of nitrogen-containing products in the urine of premature infants born to mothers with gestosis was slightly lower than in group 1 (urine creatinine 0.14±0.02



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mmol/l, p<0.01; urine urea 8.44±0.58 mmol/l, p<0.01). Azotemia in newborns of these groups can be explained by a high level of tissue catabolism. Despite the fact that nitrogen excretion increased with increasing diuresis, the rate of recovery of nitrogen-excreting renal function in newborns significantly lagged behind the rate of recovery of water-excreting function. Urea excretion was primarily reduced. It averaged 63% of total nitrogen, while in adults it was 90%; these facts explained the low urine osmolarity in premature infants during the first 7 days of life. In our studies, one of the features of premature infants born to mothers with gestosis and who had intrauterine fetoplacental insufficiency (FPI) was azotemia immediately after birth (0.089±0.02 mmol/l, p<0.001; urea 7.86±0.13 mmol/l, p<0.01), this fact was associated with reduced excretory function of the placenta in FPI. Considering that the children of these groups had high tissue catabolism processes, and the amount of breast milk received in the first 3-4 days was less due to the severe condition of the children, it is possible to note the major role of the renal factor in maintaining nitrogen homeostasis.

By the 3-4th day, this category of premature infants (25%) still had edemas in the head, shins, and back. These same children had a decrease in diuresis to 0.35 ml/hour/kg of body weight, and low urine osmolarity compared to Group 1. At the same time, the violations of the acid-base balance had the character of mixed, respiratory-metabolic acidosis, which did not tend to normalize by the end of the early neonatal period. Electrolyte metabolism disorders in premature infants born to mothers with OPG gestosis were characterized by hyponatremia and hyperkalemia. It should be noted that biochemical parameters were interconnected with clinical manifestations of electrolyte imbalance, so some newborns had agitation syndrome, multiple regurgitations, skin paresthesia, hyporeflexia, and sometimes convulsions.

Conclusions

In premature infants, there is a decrease in the osmotic concentration of urine, which increases by the end of the first week of life, but does not reach the indicators of healthy children, while the most pronounced changes are observed in the group of premature infants born to mothers with preeclampsia. Premature infants, especially those born against the background of fetoplacental insufficiency with maternal preeclampsia, by the 4th day give azotemia, which is associated with catabolic processes in the body and reduced renal excretion of nitrogenous products.

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264 | Page

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266 | Page





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ISSN (E): 2938-3765

267 | Page