Peculiarities of acute rotavirus infection in infants with perinatal exposure to human immunodeficiency virus

***H. Trotskyy[1], Y. Pakulova-Trotska[2]**

[1]Department of Pediatrics and Neonatology, Faculty of Postgraduate Education

[2]Department of Pediatrics, Faculty of Medicine No 2, Danylo Halitskiy National Medical University of Lviv, Ukraine

*Corresponding author: gtrotskyy@mail.ru. Received December 03, 2015; accepted February 5, 2016

Abstract

Background: The number of children with perinatal exposure to human immunodeficiency virus (HIV) in Ukraine is increasing, and the problems of nursing and treatment of those children are important. Rotavirus intestinal infections are common among young children and also children with perinatal exposure to HIV (PEH), and may have a hard course and negative influence on child's development.

Material and methods: We examined 40 children with PEH and 20 children without HIV and the features of their physical, psychomotor development and the course of acute intestinal infections in those groups.

Results: There was found that intestinal rotavirus infection had heavier and longer course for children with PEH, and it aggravated the underlying disease. We tested changes in medical diagnostic algorithm, including the determination of procalcytoninum, the use of lactose mixtures and antibiotics. There was found significantly positive impact on the course of intestinal infection and recovering process.

Conclusions: Feeding with high adapted mixture the children with PEH reduced the risk of acute intestinal infections (AII). Using of antibiotics on the basis of determining the level of procalcytoninum for treatment of AII in children with PEH may improve the course of AII and accelerate their recovery.

Key words: children, perinatal exposure to HIV, procalcytoninum, rotavirus.

Introduction

There are more than 50 000 children in Ukraine with intestinal infections per year. At least 25 to 50% of gastroenteritis in children under five years old was caused by rotavirus (RVI) [2, 7, 11, 12]. Therefore, more pediatricians in their practice are faced with the problem of treatment of diarrheal syndrome in children with human immunodeficiency virus (HIV). Recently, more attention is paid to the defeat of the digestive tract in HIV-infected children [1, 5, 7]. As shown in several studies of HIV-uninfected children of HIV-positive women they had significantly more common intestinal infections compared with the control group [13, 14, 16]. But if the correction with probiotics is possible in group of HIV-negative children [1], for the HIV - positive children and children with HIV with not yet certain status it creates a problem.

Objective: To increase the efficiency of differential diagnosis, treatment and prevention of diarrhea syndrome in children with perinatal exposure to HIV by studying the most common etiology, clinical course, characteristics of nutrition.

Material and methods

We examined 40 infants with perinatal exposure to HIV (PEH) and 20 infants without exposure to HIV and the features of their physical, psychomotor development and the course of acute intestinal infections in those groups. The children with PEH were treated in Lviv regional center for the control and prevention of HIV-AIDS from 2010 to 2013. The control group consisted of 40 children aged 1 to 2 years (mean age, 18 ± 3 months.) without PEH. Children of the control group were hospitalized in the Uzhgorod infectional hospital with RVI diagnosed from 2010 to 2013.

We interviewed parents of children in both groups. Also, children from both groups held general clinical examination, evaluation of physical and psychomotor development, diet and laboratory tests (general blood analysis, blood chemistry analysis, scatoscopy, a rotatest, the determination of procalcitoninum (PCT)).

Results and discussion

The physical development of children born to HIV-infected mothers at birth is primarily responsible for gestational age. Then the number of children with low and very low physical development increased.

We found by comparing the anthropometric parameters, such as height, weight, perimeter of the chest, of children with PEH and healthy children that apparently healthy children developed normally, with a tendency to the formation of excess weight (25%) or carrying excess weight (7.5%). At the same time, children with PEH had a lack of body weight (60%) or extremely underweight (27.5%) (fig. 1).

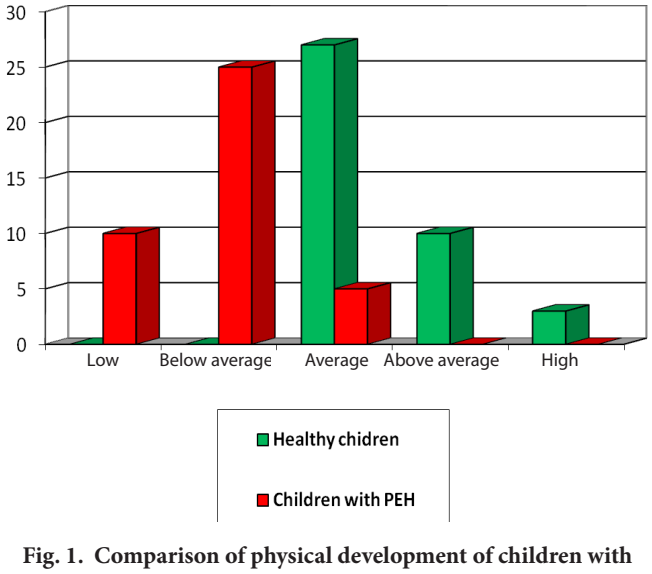

Fig. 1. Comparison of physical development of children with PEH and children without PEH (abs).

At the same time, the study of feeding the children with PEH showed that their nutrition was significantly different from nutrition of healthy children and recommendations on nutrition for young children. All the children with PEH according to the protocol were bottle-fed. A large proportion of children were fed by non-adapted formula milk (72.5%), which was accompanied by an increase in the frequency of functional disorders of the digestive system (constipation, flatulence, regurgitation and vomiting). Those disorders were observed in all children with PEH during the first year of life.

Another feature of the feeding of children with PEH was later introduction of complementary foods. The introduction of complementary foods was carried out after proper terms by an average of 5,2 ± 0,6 months. Children with PEH during the first year of life obtained mainly milk or infant formula, milk porridge and mashed potatoes. Meat products, fresh fruits and vegetables, even in the form of mashed potatoes were introduced in 12 children (30%) from the tenth to twelfth month of life, in 28 children (70%) - during the second year of life. The parents attributed this difficulty in cooking such consistency that the child is able to consume, as well as significant problems with child addiction to the new taste sensations (the introduction of new food). According to the qualitative and quantitative composition of solid food it usually does not comply to the needs of the child, in addition, the consistency of the food was liquid, rubbed (homogenized), the food is subjected to prolonged mechanical and thermal processing, which could result in lost large amounts of vitamins and trace elements.

When analyzing the cases of diseases of children with PEH, we found that 29 (72.5%) children can be attributed to a group of sickly ones. Thus, during the first year of life, 16 children (40%) were sick for 5 times, 15 ones (37.5%) – for 6 times, 9 children (22.5%) – for 7 times. There were 52 acute respiratory infections cases, 34 cases of bronchitis and 28 cases of pneumonia.

Usually regurgitation appears in the second half of the 1st month of life, on the 2nd month of life the intensity and the frequency increase and are held at the maximum level of up to 5-6 months of age. After 6-7 months of age the prevalence of regurgitation intensity gradually decreases, but in part it can be kept in 10% of children aged 12-13 months. In healthy children the frequency of symptoms of functional gastrointestinal tract is significantly reduced after the first year of life, in children with PEH we saw a different picture. In the second year of life in 26 children with PEH there were complaints of recurrent abdominal pain (65%), in 24 children (60%) was observed a tendency to constipation, 12 children (30%) had regurgitation during each meal, in 4 children (10%) there was periodic (1-2 times a day) vomiting.

We have observed that children who were fed with adaptable mixture had episodes of acute intestinal infection (AII) with a light and shorter course.

The evaluation of intestinal infections in young children was carried out by a 20-point Vesikari scale, taking into account the full clinical picture of viral gastroenteritis (severity and duration of diarrhea, vomiting, fever, dehydratation, the need for treatment). It was found that in children with PEH, compared with those born to mothers without HIV the AII preceded longer and harder. Thus, the duration of diarrhea in the main group by Vesikari scale is estimated at an average of 2.7 points, in the control group – 1.2 points. The number of defecations per day – 2.4 and 1.3 points in accordance. The duration of vomiting – 2.8 and 1.1 points, the hyperthermia – 2.6 and 1.8 points, the dehydration – 2.2 and 0.8 points ($p < 0.05$).

Almost half of the children (49 %) were noticed to have a poor appetite. It is evident that such disorders are not contributing to the full nutritional welfare of children with PEH.

In assessing the neuropsychiatric performance using modified maps formalized study of neuropsychiatric function in children during the first 7 years of his life to the creation of the profile of the psychomotor development of the child we found in children with PEH the gap in the development of motor skills, intelligence, expressive speech; as to the self-service and gaming skills at 2 months – 11 children (27.5%), at 3 months – 7 children (17.5%), at 4 months or more – in 3 children (7.5%). At the same time, the lag formation of visual and auditory perception and emotion was smaller.

Thus, the backlog of these functions in an average of 3 months we have observed in 7 children (17.5%), 4 months – in 5 children (12.5%), at 5 months or more – in 3 children (7.5%). In 12 children (30%), we noticed a slight delay in psychomotor development (1-2 months of age norms).

In assessing neuropsychiatric development of healthy children we established that it corresponded to the age in all cases.

We analyzed the illness of infants with PEH and compared it with the degree of psychomotor retardation. We found that sickly children had a greater degree of psychomotor retardation. The defeat of the respiratory system was the most common illness among young children with PEH, such as bronchitis (37.5%) and pneumonia (30%), as well as functional disorders of the gastrointestinal tract, such as abdominal pain (67.8%), constipation (60%), frequent regurgitation (30%), vomiting (10%).

On the basis of correlation analysis we have established a strong direct correlation between the degree of neurodevelopmental disability and transferred somatic diseases ($r = + 0,95$; $p < 0.01$). It was determined that frequent and prolonged physical illness intensified neuropsychiatric delay of the child's development.

Laboratory studies in the group of young children with PEH revealed that nearly half of these children (45 %) had mild anemia, mean hemoglobin levels in children of this group were 111,7 ± 6,6 g/l.

The data of biochemical blood analyses revealed that the level of total protein ranged from 66,8 ± 3,75 g/l and posted lower limit of normal, not correlated with the severity of the general condition and of nutritional status that corresponds with data of other authors. Indicators of electrolyte metabolism (K +, Na +, Cl-) corresponded to age norm indicators, the level of K + 5,1 ± 0,2 mmol/l (normal 4,14-5,75 mmol/l), Na + 136 ± 2 mmol/l (normal 133-141 mg/dl), Cl- 101 ± 2 mmol/l (normal 98-107 mg/dl). The level of glucose on

average matched normal controls and was 4,6 ± 0,4 mmol/l. The level of total bilirubin and fractions were within the age norm: total bilirubin 14 ± 0,7 mm/l (normal 8,5-20, m/l), free 1,7-17,1; associated 0,86-5 1 mm/l). Urea and creatinine also correspond to the normal indicators (3,3-5,6 mg/dl, creatinine – 18-35 m/l).

HIV polymerase chain reactions (PCR) were performed in a group of children with PEH to determine their status at the age of 3 months. All 40 children had the negative results, and in 4 children they were positive. Children whose at the age of 18 months PCR was positive for HIV had lower rates of physical development, psychomotor development and significantly lagged behind the main group of children on those parameters. Obviously, those data can be used as an aid in predicting the HIV status of a child less than 18 months of age. We made rotatest in both groups as a screening, and the result (positive) was one of the criteria for inclusion in the study.

PCR for RVI also were performed in both groups, with a view to final confirmation of the presence of RVI in children included in the study.

Determination of procalcytoninum (PCT) in the blood plasma we carried out with the purpose of its using as a marker of inflammatory activity. We noticed that in the group of children with PEH compared to healthy children, the level of PCT in serum was increased. Thus, in the group of healthy children PCT level in the serum was 0,08-0,43 ng/ml, while in the basic group - 0,31-1,02 ng/ml. The difference between groups was significant ($p \leq 0,05$).

In addition, children with PEH with severe diarrhea by the Vesikari scale have higher plasma levels of PCT that may be used to predict the course of disease and recovery. This parameter may be important in the management of the patients with acute intestinal infection (AII), as it gives the opportunity to decide if they have need in the prescription of an antibiotic. According to a number of studies [17], the optimal value of PCT for the decision on the prescription of an antibiotic is the concentration of > 0.4 ng/ml. Of course, these are only recommendatory numbers that belong to groups with inflammatory processes but not bacterial and inflammatory processes associated with local bacterial infections. The final decision on the administration of an antibiotic should take the doctor, taking into account other laboratory and clinical parameters. As for the group with a severe bacterial infection, all patients in it had higher levels of PCT – 1 ng/ml. For this reason, in inflammatory processes with severe clinical course, in case a blood concentration of PCT is more than 1 ng/ml, are recommended unequivocally antibiotics [17]. These researchers believe that when the concentration of biomarkers is less than 0.25 ng/ml antibiotics are not needed. The use of antimicrobials is recommended to start from the time when the level of PCT in the blood increases to 0.25-0.5 ng/ml. It is known that the concentration of PCT in patients with inflammatory processes is not dependent on age [18]. Taking into account this laboratory value may reduce the excessive use of antibiotics, have a positive impact on the prevention of the emergence of resistant strains of micro-organisms, and also reduce treatment costs. At the same time it significantly accelerates antibiotic treatment of infectious and inflammatory processes.

For children with AII there were characteristic signs of maldigestion and malabsorption that manifested by amylorrhea, steatorrhea, kreatoreya for 82% of children in coprograms. There were clinical signs of transient lactase deficiency after RVI in children, stool pH less then 5.5.

The protocol treatment of rotavirus infection involves the following basic therapy such as low / lactose-free diet, sorbents, enzymes, eubiotiks, oral rehydration, nifuroxazide. The application of eubiotics in children with PEH was excluded, but taking into account the reduced protective functions of the body and the possible frequent juxtaposition of a bacterial infection, children with PEH and AII may need antibiotics. On the other hand, it is known that antibiotics can worsen the clinical course of viral AII inhibiting own intestinal flora. Therefore, given the level of PCT, it was formed a group of children who need antibiotics (ceftriaxone 50 mg/kg 2 times a day intramuscular for 7 days), on the one hand, and the group of children that do not need. Also the children of the main group (20 persons) in addition to the basic therapy and antibiotics received the enterosorbent dioctahedral smectite (Neosmektin – children up to one year – 1 bag per day (3 g), 1-2 years – 2 bags per day (6 g), more than two years – 2-3 sachets per day (6-9 g)) to normalize stool frequency. The course of treatment lasted for 3.5 days. The control group (20

Table 1

Comparative characteristics of clinical symptoms of acute intestinal infections in children, depending on the assigned treatment (M ± M), days

Criteria of efficiency		The main group, = 40	Control group, n=40	P
Intoxication		2,4 ±0,51	4,1±0,63	<0,05
Fever	2,6 ±0,87	4,2±1,11	>0,05	
Vomiting	1,9 ±0,67	2,9±0,77	>0,05	
Normalization of appetite	3,6 ±1,12	5,5±1,34	>0,05	
Exsicosis	2,1 ±0,46	3,6±0,69	>0,05	
Duration of diarrhea	3,1 ±0,68	6,2±0,84	<0,01	
Duration of intensive care	1,45 ±0,51	3,2±0,71	<0,05	
Duration of hospitalization	5,1 ±0,73	7,4±0,82	<0,05	

persons) were children, matched by age and severity of the disease, but received only the basic therapy (table 1).

A comparative analysis of the elimination of the main symptoms of the disease in the group of children who received treatment with dioctahedral smectite and antibiotics, symptoms of intoxication in 14 children (70 %) disappeared on Day 2, and Day 3 – in 17 patients (85 %), while in the comparison group only 6 children ($\chi 2 = 6,54$, $p = 0,016$). In children who received enterosorbent stopped vomiting and diarrhea. On the 3-day of treatment vomiting ceased in 85 % of patients of the main group, while in the comparison group vomiting disappeared only in 70% ($p < 0,05$). In the control group of patients who did not receive dioctahedral smectite in the treatment, the average stool frequency on the first day of treatment remained the same, and the improvement of stool has been reported. On 4-5 days of treatment with dioctahedral smectite, clinical recovery with normalization of the stool occurred in all patients, while in the comparison group clinical recovery occurred only in 80% of cases.

Conclusions

Children with PEH, although according to the protocol are treated as practically healthy children, but actually they are not. For children with PEH was inherent the delay in physical and neuropsychological development and eating disorders. All those features affected the formation of the child's resistance to pathogens. Feeding with high adapted mixture the children with PEH reduced the risk of AII. Children with PEH are classified as sickly children. For children with PEH the course of the disease with longer and severe duration with lengthened period of convalescence was typical. Consequently, those children required special attention in terms of primary and secondary prevention of the most common pathologies of childhood, as well as considering the peculiarities of the period of reconvalescence. The use of antibiotics on the basis of determining the level of PCT for treatment of AII in children with PEH may improve the course of AII and accelerate their recovery.

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