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COURSE AND TREATMENT METHODS OF ACUTE INTESTINAL INFECTIONS IN CHILDREN

Oripova Jamila Nematovna

Department of Infectious diseases, Andijan State Medical Institute,

Andijan, Uzbekistan

Abstract: The greatest danger for children with acute intestinal infections is dehydration. The therapeutic approach to managing such patients involves early administration of oral rehydration solutions. Meanwhile, the widespread introduction of low-osmolar solutions for oral rehydration does not completely solve the problem of quick and effective relief of dehydration syndrome.One of the innovative pathogenetic approaches to oral rehydration is the use of a complex preparation of tannic acid and gelatin. The drug has a local effect on the wall of the digestive tract, reducing the severity of the inflammatory process, which ensures greater safety of its use, especially in pediatric practice [1].

Keywords: Intestinal infections in children, intestines in children, dehydration, epidemiology, infectious diseases, pediatrics.

The prevalence of acute intestinal infections (AI) throughout the world and the possibility of deaths, especially in pediatric practice, dictate the need for constant optimization of diagnostic and therapeutic approaches in accordance with modern scientific data. The syndrome in the pathogenesis of acute intestinal infections that poses the greatest danger to children and requires urgent therapeutic measures is dehydration. According to the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), approximately 1.5 million children under 5 years of age die each year as a result of dehydration associated with acute infectious diarrhea. Globally, mortality caused by dehydration in acute intestinal infections is the second most important in pediatric practice after acute pneumonia [1]. These issues are the focus of constant attention of practicing physicians.

The severity of acute intestinal infections in children is largely determined by the amount of fluid loss, and the assessment of the degree of dehydration is of particular importance. The gold standard for diagnosing dehydration is assessing the patient's acute weight loss. Thus, degree I exicosis corresponds to a loss of up to 5% of body weight (up to 50 ml/kg of fluid), degree II exicosis corresponds to a loss of 6–10% of body weight (60–100 ml/kg), degree III exicosis corresponds to a loss of more than 10% of body weight. body (110–150 ml/kg). Dehydration, characterized by a loss of body weight of more than 20%, is incompatible with life [2]. However, in pediatric practice, the true weight of the child before illness is usually unknown, so the degree of dehydration is assessed based on clinical data. Failure to timely determine the degree of dehydration in children with ACI increases the duration of the disease and increases the risk of death.

Clinical symptoms of dehydration in children traditionally include an assessment of the general condition, characteristics of the underlying disease (frequency of stool, vomiting, fever), the presence of thirst, lethargy, weakness, decreased skin turgor, retraction of the large fontanel (in children of the first year of life), the condition of the mucous membranes , cardiovascular system (pulse, arterial and central venous pressure), assessment of respiratory parameters, diuresis.

According to clinical studies conducted in which the specificity and sensitivity of various symptoms of dehydration (thirst, lethargy, pulse rate, breathing parameters, diuresis, etc., 10

parameters in total) were studied, the four main clinically significant manifestations of exicosis in children with acute intestinal infections are recognized as an increase in capillary refill time of more than 2 seconds, absence of tears, dry mucous membranes and the degree of manifestation of general symptoms of intoxication.

Clinical assessment of dehydration according to these parameters is carried out using a point system: 0 points - no dehydration, 1 point - mild dehydration (fluid deficiency less than 5%), 2 points - moderate (deficiency 5-9%), more than 3 points - severe (deficiency more than 10%) [3, 4]. Laboratory diagnostic methods also make it possible to objectively assess the type and severity of exicosis. Many experts note that one of the most informative indicators reflecting the degree of dehydration in acute intestinal infections in children is the level of bicarbonate in the blood serum and the routine determination of the hemoglobin/hematocrit ratio. The parameters of creatinine, urea, as well as blood pH and anions are not sufficiently informative [5].

Based on clinical and laboratory changes, it is customary to distinguish three types of dehydration in children - isotonic, hypotonic, hypertonic. The isotonic type is characterized by a proportional loss of fluid and electrolytes, primarily sodium. At the same time, there is no change in the osmotic pressure of water in the intra- and extracellular space, which makes it difficult to determine by physical methods. This type of dehydration is most often observed in acute intestinal infections in children. Clinically characterized by lethargy of the patient, pallor of the skin, decreased skin elasticity and turgor, dry mucous membranes, muffled heart sounds, and a moderate decrease in blood pressure.

With hypotonic dehydration, there is a greater deficiency of electrolytes (particularly sodium) than of fluids. This type of dehydration is observed in 10–15% of cases of acute intestinal infections in children. Clinically manifested by increasing lethargy, drowsiness, repeated vomiting, severe pallor with a bluish tint to the skin, soft sunken eyeballs [6]. Characterized by low body temperature, decreased blood pressure, oliguria or anuria, atony and intestinal paresis, tonic or tonic-clonic convulsions are possible. One of the complications of this type of exicosis associated with hyponatremia is the development of cerebral edema. Laboratory examination for this type of exicosis shows an increase in hematocrit by 10–12% of age-related values, hyperproteinemia up to 80–82 g/l, and signs of metabolic acidosis.

With the hypertensive type of dehydration, the fluid deficit exceeds the electrolyte deficit. This type is characterized by a gradient of osmotic pressure of the fluid between the intracellular and extracellular fluid towards the latter; with ACI in children it occurs in 10–20% of cases. Unlike other types of dehydration, the hypertensive type is most characterized by agitation, anxiety, tachycardia, increased blood pressure, a tendency to muscle hypertonicity, and convulsions [6].

Extracellular fluid deficiency in isotonic and hypotonic types of dehydration can be assessed using Rachev's formula as the difference between the patient's hematocrit and the normal value of this indicator, divided by 100, minus the product of the normal hematocrit value, multiplied by the patient's body weight in kilograms, divided by a factor of 3 in children up to 1 year or coefficient 5 in children over 1 year and adults [5].

In 1970, WHO recommended formulations with a total osmolarity of 311 mmol/L for oral rehydration. The main disadvantage of the basic solutions proposed by WHO is the lack of a positive effect on diarrhea syndrome. Therefore, work on creating new modern formulas that can influence the frequency and volume of stools was continued. One of the directions was the WHO proposal in 2004 to reduce the osmolarity of oral rehydration solutions to 245 mmol/L, sodium

concentration to 75 mmol/L and glucose to 75 mmol/L. The previous formula had higher osmolarity compared to blood plasma. This could contribute to the development of hypernatremia, but did not affect the volume of feces during diarrhea, which is especially important in children of the first year of life [7]. Conducted in 2001 by S. Hahn et al. A meta-analysis of 15 randomized clinical trials from around the world showed that the use of reduced-osmolarity solutions for oral rehydration optimizes the absorption of water and electrolytes in the intestine compared with the use of hyperosmolar solutions. In addition, these patients were less likely to require infusion therapy, the severity of diarrhea and vomiting was less, and there were no cases of clinically significant hyponatremia, except in cases of cholera [2]. At the same time, it should be recognized that the widespread introduction of low-osmolar solutions for oral rehydration does not completely solve the problem of quick and effective relief of dehydration syndrome in children; it is necessary to develop and implement new methods of treating these conditions.

One of the innovative pathogenetic approaches to oral rehydration is the use of a complex preparation of tannic acid (tannin) and gelatin. In foreign clinical studies, this dosage form (Tasectan®, Tanagel®) has proven its effectiveness, including in pediatric practice. The principle of action of the complex of tannic acid and gelatin is the mechanical protection of the intestinal mucosa due to the ability to form a film on its surface [8]. As a result, the severity of diarrhea syndrome decreases. From a pharmacological point of view, the named complex drug is characterized by an astringent, anti-inflammatory and cytomucoprotective effect, while it does not affect the microflora of the gastrointestinal tract and intestinal motility, which makes it the drug of choice in children with acute intestinal infections. The complex included in the drug remains unchanged in the acidic environment of the stomach, its main action is carried out in the alkaline environment of the intestine, where it breaks down into components - tannin and gelatin.

Tannic acid (tannin) is a phenolic compound of plant origin. Aqueous solutions of tannin form precipitates with alkaloid salts, gelatin and protein solutions, heavy metal salts, oxidizing agents and acids. The astringent effect of tannin is due to the ability to precipitate proteins with the formation of dense albuminates, which upon contact with the mucous membrane forms a film. Pathomorphologically, local vascular spasm, decreased secretion, compaction of cell membranes, and decreased intensity of the inflammatory process are noted. The effect of tannin on mucosal proteins is reversible [3]. Tannin as monotherapy when taken orally has a number of undesirable effects. When administered orally, it interacts with proteins in the gastric mucosa and can lead to symptoms such as nausea and vomiting, and in the intestine, inhibit the absorption of iron and other metals. The use of tannin in complexes with albumin (tanalbin) or gelatin to form hydrolytic bonds prevents the above-mentioned negative effects affecting the gastric mucosa or metal absorption [9]. A number of studies on the effect of tannins on intestinal motility have noted the absence of an effect on reducing intestinal motility [4].

Studies have shown that in addition to the mechanical astringent effect, the gelatin-tannin complex significantly reduces the severity of inflammatory processes in the intestines due to the simultaneous action of several inflammatory mediators, in particular, by inhibiting the release of pro-inflammatory cytokines [10]. For example, it has been shown that this drug is able to suppress the in vitro release of interleukin-8 and tumor necrosis factor alpha from intestinal epithelial cells stimulated by lipoprotein complexes, and does not have a cytotoxic effect on these cells. The greatest anti-inflammatory effect in the experimental model was observed when a complex preparation of gelatin and tannin was combined with prebiotics (inulin) and probiotics, in particular the lactobacilli Bacillus clausii [5].

One of the latest comparative clinical studies of a complex preparation of gelatin and tannin in children was an observation carried out in Spain on 239 patients with ACI. 28 patients dropped out of the study as not meeting the inclusion criteria; the effectiveness of therapy was analyzed in 211 patients. The study involved children aged from 3 months to 12 years, who had acute intestinal infections for no more than 72 hours and had frequent loose stools more than 3 times a day. All patients were divided into two groups: the main group consisted of children, in whose treatment, along with oral rehydration, a complex preparation of gelatin and tannin was used (97 children), the comparison group - patients in whose treatment only oral rehydration was used (114 children). The average age of patients in the study was 2.3 years in the comparison group and 2.6 years in the main group. The number of children under 2 years of age in both groups exceeded 50% (59.8 and 54.3%, respectively).

The criterion for the effectiveness of therapy was the stool frequency reduction index (SDI), calculated as the difference between the stool frequency 12 hours after the start of therapy and the initial stool frequency, divided by the initial stool frequency. The dynamics of other clinical symptoms (patient weight, duration and severity of fever, vomiting, stool characteristics and symptoms of peritonitis/sepsis) were also taken into account. The study revealed a statistically significant reduction in the frequency and improvement of stool character in patients of the main group. Other clinical symptoms, such as frequency of vomiting, development of dehydration, weight change, presence of hemocolitis, and symptoms of peritonitis/sepsis, did not show statistical differences between the two groups. The stool frequency reduction index (SDI) after 12 hours of therapy decreased by 18% in the comparison group and by 60% in the main group, which is a statistically significant difference [5].

Conclusions:

As this clinical study has shown, combined therapy of oral rehydration and a drug based on a gelatin-tannin complex has an advantage over monotherapy (oral rehydration). No adverse events were recorded during the study.

Thus, the widespread introduction into clinical practice of a new treatment method based on pathogenetically based local mechanical effects could become an alternative to existing methods of treating acute diarrhea.

The complex of gelatin and tannin does not have a systemic effect; it has a local effect on the wall of the digestive tract, reducing the severity of the inflammatory process, which ensures greater safety of its use, especially in pediatric practice.

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