

Enterosorption in paediatric practice: selection of the optimal sorbent

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Abstract

The main properties of enterosorbent Enterosgel®(paste) were analyzed. It was found that sorption-detoxication action of this medication improves the state of gastrointestinal tract and mucous membranes, and evokes a number of positive "distant" effects, such as inhibition of lipid peroxidation, decrease in the content of circulating immune complexes and pro-inflammatory cytokines, subcompensation of immunodeficiency, activation of liver and kidney function, etc. Besides, this medication is quite safe. The inclusion of detoxicant Enterosgel® in the combined therapy allows to significantly improve the results of treatment of various diseases in children.

Key words

Enterosorbition, Enterosgel®, allergy, paediatrics.

Enterosorbition is known to be a non-invasive method of detoxification used for the elimination of allergens, mediators, allergic reaction products, metabolites, toxins, active peroxide compounds, pathogens and viruses from organism [1, 5]. In paediatric practice, enterosorbents are used in the combined therapy of allergic diseases, acute intestinal infections, diseases of the gastrointestinal tract (GIT), hyperbilirubinemia, hyperasotemia, acute and chronic intoxication of different origin, acute poisoning by potent and poisonous substances and other diseases [8, 9].

While in the intestinal lumen, enterosorbents bind toxic substances without direct contact with blood, thereby reducing the level of toxins in the organism on the whole. The number of toxic substances penetrating from the intestinal lumen into the blood depends on the state of the intestinal mucosa (entero-hematic barrier); consequently, the efficacy of the enterosorbent therapy is also determined by the correlation of an enterosorbent with the latter [8]. With sorption activity to substrates damaging the entero-hematic barrier (deconjugated bile acids, toxins of bacteria, etc.), the sorbent at the same time must have a limited range of substances sorbed. Thus, the continued use of the sorbent capable of binding large molecular substrates, such as secretory IgA (sIgA), can lead to the impairment of entero-hematic barrier immune component. Hereby, one of the important properties of enterosorbent is selective sorption of its action [8, 9].

It is also noteworthy that the sorbent should not penetrate the intestinal mucosa and therefore should have an expressed hydrophobic surface [8].

The intestinal bacterial flora is the a defense system of the organism. Its effect is not limited to the gastrointestinal tract, covering the organism as a whole, due to the direct and indirect participation in immunogenesis and synthesis of a large number of biologically active antitoxic substances. Therefore, the use of enterosorbents should not lead to the development of intestinal dysbiosis, but on the contrary - it should contribute to the removal of pathogenic organisms [5, 8, 9].

Taking into consideration the necessity of full compliance with the properties of the "ideal" enterosorbent, studies of the structure, physico-chemical and pharmacological characteristics of the new porous silicone sorbents were undertaken. It was found that the enterosorbent Enterosgel® (paste) corresponds to the above properties to the greatest degree.

Enterosgel® - the original silicone medicinal product intended for the elimination of toxic substances, correction of intestinal microbiocenosis and restoration of gastrointestinal mucosa epithelium. The medicine is highly biocompatible and has virtually no side effects and contraindications.

Enterosgel® has the following set of properties:

1. Sorption detoxification action. There are two mechanisms of Enterosgel®'s binding activity - molecular adsorption and coprecipitation in gel. The medication has a porous globular structure (sponge-like) with a set pore size (mainly mesopores), which allows adsorbing medium-molecular toxic metabolites (with a molecular weight of 70-1000 Da) - bilirubin, cholesterol, urea, creatinine. Substances with a molecular weight of less than 60-70 Da (metal ions, mineral salts, electrolytes) are virtually not bound by the medicine. Through its

coprecipitation mechanism, Enterosgel® is capable of binding macromolecular compounds, including different mediators, ferments, bacterial endotoxin (lipopolysaccharide, LPS) and others. Apparently, this is due to a number of stereotypical "distant" (extraintestinal) positive effects that are observed during the intake of Enterosgel® in various pathological conditions: inhibition of lipid peroxidation, decrease in the content of circulating immune complexes and pro-inflammatory cytokines (reduction of the severity of the systemic inflammatory response), subindemnification of immunodeficiency, activation of detoxifying and synthetic functions of the liver, improvement of the kidney function, increase of regenerative-reparative potential of a number of organs and tissues in general [6].

2. Unlike other enterosorbents, the surface of Enterosgel® is of organic nature, due to the presence of globules of methyl and hydroxyl groups on the surface, entailing the hydrophilic-hydrophobic properties, affinity to biological tissues of an organism and, accordingly, the safety of the medicine [2, 4].
3. Interaction with gut microflora. The medicine binds and eliminates pathogens from the gastrointestinal tract, their metabolic and decomposition products. Gram-positive and Gram-negative bacteria and fungi of the genus *Candida* are subject to adhesion. The medication does not inhibit the saprophytic intestinal microflora (*bifidobacteria*, *lactobacilli*, etc.). The elimination of pathogenic organisms from the gastrointestinal tract occurs physiologically and leads to normalization of microbiocenosis. Moreover, Enterosgel® binds and removes viruses, such as rotavirus, hepatitis A virus and others [6].
4. Enterosgel® enhances the state of the gastrointestinal lining, promoting its recovery by means of sorption of toxic waste products from microflora, which are harmful for the gastrointestinal epithelium, sorption of products of incomplete metabolism, as well as enveloping and regenerative qualities of the medicine [6, 11].
5. Detoxification with Enterosgel® improves the state of all parts of the immune system, promoting compensation for secondary immunodeficiency and reducing autoantibody titer and content of circulating immune complexes in blood plasma [6, 12]. Enterosgel® enhances the immune defense of the epithelial barrier of the intestinal mucosa. The level of sIgA, responsible for local security and protection of mucosal surfaces against the penetration of micro-organisms, increases in the lumen of the intestine [11]. The use of Enterosgel® lowers the level of bacterial endotoxin (LPS), the excess of which depresses the immune system and adds extra load to a number of pathological processes [6, 10].

The inclusion of non-invasive methods of efferent therapy using enterosorbents in the already adopted and widely used regimens has been proven to improve the efficiency of the treatment [4-6].

Allergic diseases are highly frequent in paediatric practice, and the development of these diseases mostly owes to the pathology of the digestive system. Sensitization to food products, hydrolysis and absorption of which occur in the gastrointestinal tract, is the basis of pathogenesis of many allergy forms. Therefore, any pathological processes entailing changes in the permeability of the intestinal barrier control systems and reduction of the level of sIg A affect absorption of antigens that are usually accompanied by an increase in allergic reactions. All this opens up broad prospects for application of enterosorbent Enterosgel® in the treatment of various allergic diseases.

Enterosgel® actively binds food and non-food allergens, diminishing antigen load on the immune component of intestinal barrier and sorbing microbial toxins that damage gastrointestinal mucosa. The medicine protects the mucosal epithelium from exposure to toxins, restoring control systems of intestinal barrier permeability. In its turn, the recovery of the intestinal barrier leads to a decrease of excessive levels of endotoxin of gram negative bacteria in the blood and a rise of sIg A in the intestinal lumen. These processes result in prevention and reduction of the severity of allergic reactions.

In such a manner, Enterosgel® improves the efficiency of treatment of allergic diseases, due to the following mechanisms: 1) normalizes the function of the digestive tract and immune system; 2) restores the normal composition of intestinal microflora; 3) reduces antigenic load on the digestive system and immune barrier of the intestine; 4) reduces the level of sensitization; 5) binds food and non-food allergens in the digestive tract; 6) reduces the severity and duration of exacerbation of skin and respiratory allergies, increases the duration of remission and reduces the number of relapses.

High clinical efficacy of the medicine Enterosgel® allows its wide application in the treatment of various allergic diseases including atopic dermatitis, angioneurotic angioedema, asthma, and hay fever, due to its capability of decreasing sensitization, positively influencing on the composition of intestinal microflora, digestion and absorption processes, and improving the immune system.

According to the references, the prescription of Enterosgel® to patients with urticaria allows full arrest of urticaria rashes and itchy skin by the 5th day from the start of the treatment and prevents relapses of the disease in patients with chronic urticaria [1, 3, 6].

In children with atopic dermatitis aggravated by secondary infection, inclusion of Enterosgel® in the combination therapy resulted in a significant decrease in total IgE levels compared with children who received only anti-allergic treatment and antimicrobials. The obtained data attests to a falling level of sensitization in children administered with Enterosgel®, which reduces weight and the period of exacerbation, increasing the duration of remission, i.e. allowing for a long-term positive effect [2, 3].

Enterosgel® has proven itself as an effective tool for the treatment of respiratory forms of allergic diseases. The use of Enterosgel® in patients with atopic asthma promotes faster relief of bronchial obstruction, improvement of external respiratory function indices and reduction of the duration of bronchodilator administration.

The use of Enterosgel® in the treatment of patients with allergic diseases can shorten the inpatient treatment time by 10-15%, reduce the dose of antihistamines, glucocorticoid hormones, bronchodilators, and cut treatment costs by 15-20% [2, 7].

The new medicine Enterosgel® with a sweet taste, paste for oral use, has enhanced therapeutic and consumer properties, and is mostly targeted on children. Enterosgel® (paste) should be taken 1-2 hours before or 2 hours after the meal or intake of other medicine, washing down with water. Children under 3 years old are administered 1 teaspoonful (5 g) 2 times per day (10 g), from 3 to 5 years old – 1 teaspoonful (5 g) 3 times per day (15 g), from 5 to 14 years old – 1 dessert spoonful (10 g) 3 times per day (30 g).

In patients with chronic intoxications Enterosgel® is administered at a dose of 30 g per day for 7-10 days per month. In patients with severe intoxications, the dose can be doubled during the first three days. The duration of the treatment in cases of acute poisoning is 5-7 days, and in cases of chronic intoxications and allergic conditions - 2-3 weeks. Repeated courses may be held upon the doctor's recommendation.

Thus, summarizing the abovementioned data, it can be concluded that the inclusion of the effective and safe detoxifier Enterosgel® into the combined therapy helps to significantly improve the results of treatment of allergic diseases, as well as many other disorders in children.

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