

Effectiveness of Hypertonic Solutions in the Treatment of Acute Rhinosinusitis in Children

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Annotation: The article is devoted to the problem of acute rhinosinusitis in children. Individual research data on the evaluation of the effectiveness and feasibility of using hypertonic solutions of sea water in the complex treatment of rhinosinusitis are presented. It has been shown that the inclusion of a spray with a hypertonic solution of sea water in the treatment scheme allows to achieve improvement of the objective parameters of the nasal function and the patient's condition in a short period of time, shortens the overall duration of the disease, and reduces the risk of its complications.

Introduction. Acute rhinosinusitis is one of the most common diseases of the ENT organs in all age groups, ranking 5th among all infections in terms of the number of antibiotics prescribed [1, 2]. The leading places among the causative agents of acute sinusitis in children are occupied by *Streptococcus pneumoniae* - 36%, *Haemophilus influenzae* - 23%, *Moraxella catarrhalis* - 20% [3], and the spectrum of causative agents and their percentage ratio have remained unchanged in recent years. The study of the main causative agents and the characteristics of the clinical course of rhinosinusitis allows us to conclude that in most cases this pathology develops after a previous respiratory viral infection. The average duration of upper respiratory tract diseases during a lifetime is estimated to be 1 to 2 years. In Russia, according to various sources, from 10 to 15 million people are affected by rhinosinusitis annually. In the first stage of the disease, the virus adheres to the mucous membrane of the upper respiratory tract. The outcome of this contact (the development of an inflammatory reaction or the elimination of the pathogen) depends on the state of the epithelium of the upper respiratory tract. That is why the issues of rational treatment and prevention of upper respiratory tract respiratory infections (and their complications) are closely related to the normalization of the functioning of the ciliated epithelium, which is impaired in inflammation of any etiology [4–8]. Various groups of drugs can be used to normalize mucociliary clearance and eliminate the inflammatory process. Taking into account the etiopathogenesis, antiviral or antibacterial (etiotropic) drugs occupy a leading place in this list. However, one should not forget about the sensitivity (growth of resistance) of causative pathogens to this group of drugs.

It is widely used in topical therapy of rhinosinusitis

- means for irrigation-elimination therapy;
- topical decongestants;
- steroid anti-inflammatory drugs;
- topical mucolytic drugs.

In the treatment and prevention of diseases of the upper respiratory tract The experience of using irrigation-elimination therapy goes back thousands of years and is fully justified. Since the time of Hippocrates, nasal irrigation with saline solutions has been considered an important stage in the local

treatment of nasal diseases. The results of numerous modern studies indicate the positive effect of moistening the mucous membrane on mucociliary activity, as well as the safety of the procedure, which has no documented serious side effects, which allows it to be used in the treatment of rhinosinusitis in children [9, 10]. Nasal irrigation with saline solutions helps to reduce the impact of various microorganisms and harmful particles in the inhaled air on the nasal mucosa, making it difficult to resorb toxins and allergens. Isotonic, hypo- and hypertonic solutions of sodium chloride are used in daily practice for nasal irrigation. These solutions dilute mucus and regulate its production by goblet cells, soften the drying secretion, improve blood circulation of the mucous membrane, increase its sensitivity and reactivity. The salt concentration in the isotonic solution is close to the salt concentration in the body's fluid environments, therefore it has a mild therapeutic effect on the nasal mucosa, contributing to the normalization of the hydro-ionic balance, the violation of which is accompanied by swelling of the nasal and sinus mucosa. Hypertonic saline has a higher salt concentration, which leads to an accelerated movement of water towards a higher concentration of ions and has a pronounced anti-edema and stimulating effect. [11].

Hypertonic saline has been shown to restore ciliary epithelial function more effectively in patients with chronic sinusitis, while isotonic saline has been shown to improve mucociliary transport in patients with allergic rhinitis and acute sinusitis [12]. This also applies to seawater, which is similar in composition to chloride-sodium mineral waters. The beneficial effects of seawater, which is predominantly sodium chloride (more than 70% of all salts) on the nasal mucosa, are due to the unique properties of its physicochemical composition. Under the influence of salt, the production of nasal mucus by goblet cells is normalized, and nasal secretions are liquefied. Microelements in seawater (mainly Ca, Fe, K, Mg, Cu) lead to the normalization of the function of the ciliated epithelium, an increase in the resistance of the nasal mucosa to infection, and an improvement in the subjective sensations of patients. When comparing the effects of hypertonic solutions of Dead Sea salts and hypertonic saline solutions of sodium chloride on the quality of life of patients with chronic rhinosinusitis, it was shown that both groups of patients improved, but the quality of life indicators were better in the use of seawater [13, 14].

The purpose of the study was to evaluate the effectiveness of hypertonic solutions in the treatment of acute rhinosinusitis in children.

Research materials and methods. Multidisciplinary clinic of Samarkand Medical University, Department of Otorhinolaryngology, severe nasal congestion, excessive discharge of mucous or mucopurulent discharge from the nose, nasal cavity 100 children aged 2-15 years, who were treated in outpatient or inpatient settings with itching and maceration in the nasal cavity, decreased sense of smell, and periodic dryness in the nasopharynx, were examined. In addition to the standard otolaryngological clinical examination, the examination regimen of patients included nasal cavity radiography, endoscopy, and anterior active rhinomanometry.

One of the drugs based on sea water is hypertonic AQUALOR forte (PharmaMed, Canada). This spray is a natural sterile hypertonic sea water (salt content - 21 g / l) intended for washing the nasal cavity, which contains all the active substances and trace elements of sea water necessary to maintain the normal physiological state of the nasal mucosa (Mg, Zn, Se, Cu, Fe, I, Ca, Na, etc.). The spray is equipped with a nozzle that provides a powerful shower spray. The effectiveness and tolerability of this drug in the complex treatment of acute uncomplicated rhinosinusitis were evaluated in an open comparative randomized study involving children aged 2 to 15 years who received a course of treatment in outpatient or inpatient settings for acute uncomplicated rhinosinusitis. The diagnosis is made on the basis of complaints, physical examination and special examination methods (nasal radiography, endoscopy).

In addition to subjective assessment of the severity of acute rhinosinusitis symptoms, objective monitoring was performed, which included the following:

- endoscopic examination of the nasopharynx (presence of hyperemia and edema in the mucous membrane of the nasopharynx, the nature of the discharge);

- previous active rhinomanometry (allows to assess the ventilatory function of the nose).

The essence of active rhinomanometry is to measure nasal resistance (based on quantitative measurement of nasal airflow and pressure). Nasal resistance is measured in pascals (PA), volumetric flow in cubic centimeters per second (cm³/s). The results are given in the International System of Units (SI): Pa/cm³ per second. All results were entered into the patient's individual card. 100 children were observed, divided into 2 groups. The distribution of subjects into groups was carried out according to a table of random numbers (created using the standard function of the Statistica 6 statistical software package).

Group 1 (main) - consisted of 50 patients who, in addition to the standard therapy of the disease (topical decongestants 3 times a day and antibacterial drugs taken orally according to the scheme), received daily (at least 4-6 times a day) nasal irrigation with AQUALOR forte hypertensive spray for 7-10 days. Group 2 (comparison) - consisted of 50 patients who received only standard treatment (antibiotic and topical decongestant).

Patients with exacerbation of chronic sinusitis or complicated acute sinusitis were excluded from the study. The following criteria were used to assess the effectiveness of treatment:

- recovery — complete disappearance of clinical symptoms of the disease;
- improvement — a significant reduction in the expression of clinical symptoms of the disease;
- lack of effectiveness - lack of positive dynamics, exacerbation of disease symptoms.

Inspection results. Before starting treatment, all patients had similar complaints: severe nasal congestion, copious mucous or mucopurulent nasal discharge, itching and maceration in the nasal vestibule, decreased sense of smell, and periodic dryness in the nasopharynx. Previous rhinoscopy revealed hyperemia and edema of the nasal mucosa, severe narrowing of the common nasal passages, and copious mucous or mucopurulent discharge. Subjective and objective assessments of acute uncomplicated rhinosinusitis in the observed patients before, during, and after treatment are presented in Table 1. Standard therapy (antibiotic and topical decongestant). In addition, in the main group of children who received hypertensive spray, a decrease in the severity of clinical symptoms was noted on the 3rd day of treatment. In 54% of patients (according to parents), a significant decrease in dryness of the nasal and nasopharyngeal mucosa was observed. On the 3rd-4th day of treatment, subjective improvement of the condition was noted in 76% of patients. The rhinoscopic appearance of patients in this group was characterized by a significant decrease or disappearance of edema or hyperemia of the nasal mucosa on the 5th-7th day of treatment, the absence of mucous discharge from the nasal cavity, and the restoration of the sense of smell. Also, the frequency of use of topical decongestants in the main group decreased: already on the 3rd day of treatment, 100% of children used these drugs only before bedtime, which was enough to ensure free nasal breathing throughout the day.

Table 1. Expression of symptoms of acute uncomplicated rhinosinusitis in children before and after treatment on a 10-point visual analogue scale

symptom	Day 1		Day 2		Day 3	
	main	control	main	control	main	control
An increase in body temperature	4	4	3	4	1	2
Weakness	6	6	4	5	1	2
Intoxication	5	5	4	4	1	2
Mucous discharge from the nose	6	6	3	4	0	1
Nasal breathing disorder	6	6	4	6	2	3

Mucous membrane hyperemia	6	6	3	5	1	3
Flow along the back wall of the larynx	5	5	2	3	0	1
Discharges are purulent	6	6	2	3	0	1

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