

THE ROLE OF NEBULIZER USE OF ACETYLCYSTEINE IN THE TREATMENT OF RECURRENT OBSTRUCTIVE BRONCHITIS IN CHILDREN

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Abstract

Recurrent obstructive bronchitis is a pathological condition with recurring episodes of bronchial obstruction against the background of acute respiratory infections. The aim of the study was to investigate the role of 10% acetylcysteine nebulizer in the treatment of recurrent obstructive bronchitis in children. The use of nebulizer inhalations with acetylcysteine led to a significant ($P < 0.05$; $P < 0.01$) reduction in the duration of oxygen therapy, a reduction in inpatient treatment of patients by an average of 0.3 and 0.9 days in patients of group II compared with patients who received standard therapy for the disease. Thus, the use of nebulizer inhalations of a 10% solution of acetylcysteine in recurrent obstructive bronchitis in children helps to reduce the intensity and duration of cough, sputum viscosity, leads to a significant decrease in the severity of bronchial obstruction according to E:I index. The use of the drug causes a decrease in the duration of oxygen therapy and the duration of inpatient treatment, which makes it possible to recommend the use of this method in the treatment of the disease.

Keywords: Acetylcysteine, children, nebulizer therapy, recurrent obstructive bronchitis.

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Resume

Recurrent obstructive bronchitis is a pathological condition with recurrent episodes of bronchial obstruction against the background of acute respiratory infections. The aim of the study was to study the role of nebulizer use of 10% acetylcysteine in the treatment of recurrent obstructive bronchitis in children. The use of nebulizer inhalations with acetylcysteine resulted in a significant ($P<0.05$; $P<0.01$) reduction of the duration of oxygen therapy, reduction of inpatient treatment of patients by an average of 0.3 and 0.9 days in group II patients compared with patients receiving standard therapy of the disease. Thus, the use of nebulizer inhalations of 10% acetylcysteine solution in recurrent obstructive bronchitis in children helps to reduce the intensity and duration of cough, sputum viscosity, leads to a significant decrease in the severity of bronchial obstruction according to the E:I index. The use of the drug causes a decrease in the duration of oxygen therapy and the duration of inpatient treatment, which allows us to recommend the use of this method in the treatment of the disease.

Keywords: Acetylcysteine, children, nebulizer therapy, recurrent obstructive bronchitis.

Relevance

Recurrent obstructive bronchitis is a pathological condition with recurring episodes of bronchial obstruction against the background of acute respiratory infections, which most often occurs in young children, i.e. that period of life in which there are certain morphological features of the bronchial tree and increased reactivity of the bronchi to various environmental factors [1,3].

An important mechanism for the development of bronchial obstruction in children is a violation of bronchial secretion. The produced thick and viscous secret, in addition to inhibiting ciliary activity, can cause bronchial obstruction due to accumulation in the airways. Violation of mucociliary clearance leads to sputum stagnation, the drainage function of the bronchi suffers, the ventilation function of the lungs is impaired, the effectiveness of protective mechanisms - mucociliary transport and cough decreases, the colonization of the bronchi by pathogenic microflora increases, which leads to the maintenance and progression of



inflammation and bronchial obstruction. Numerous studies have established that the properties of ACC are due to the presence of a free sulfhydryl group, which, in contact with liquids and other biological compounds, easily gives up a hydrogen atom, becomes bipolar charged, which allows it to combine with free radicals and other molecules [2,4,5]. It is these chemical reactions that determine the development of the mucolytic, antioxidant and detoxic effect in the patient's body [8]. It is believed that under the influence of ACC, the rate of mucociliary clearance increases, the secretion of less viscous sialomucins by goblet cells is potentiated, and the content of sol increases, which helps to restore the function of the ciliated epithelium, leading to improved elimination of mucus from the respiratory tract [7]. All these properties make it possible to speak of ACC not only as a mucolytic agent, but also as a mucokinetic agent affecting various parts of the inflammatory process of the bronchopulmonary system. Thus,

Target. To study the role of nebulizer application of 10% acetylcysteine in the treatment of recurrent obstructive bronchitis in children.

Materials and research methods. A study was conducted of patients with recurrent obstructive bronchitis who were hospitalized in the pulmonology departments of the Samarkand Regional Multidisciplinary Children's Medical Center. The criteria for hospitalization and enrollment in the study group were as follows: diagnosis - recurrent obstructive bronchitis, RDAI score ≥ 6 points, E:I index score > 1.40 , failure of home treatment for ≥ 48 hours, absence of severe background and intercurrent diseases, parental consent to conduct research, the ability to obtain correct anamnestic data from the parents of patients. The design was consistent with a randomized controlled clinical trial.

The exclusion criteria from the observation groups were the presence of chronic diseases of the cardiovascular and respiratory systems, the lack of parental consent in conducting research work, the inability to obtain accurate anamnestic data of patients.

In total, 62 patients with recurrent obstructive bronchitis who met the inclusion criteria were selected for the study, while during the study 2 patients were excluded from observation for various reasons. As a result, 60 patients took part in the study. The patients were randomly divided into 2 groups. Group I (main) included 30 patients who received standard therapy, in addition to which nebulizer inhalations of acetylcysteine were performed. Group II (comparison) included 30 patients who



received standard therapy. In group I, a 10% solution of acetylcysteine was used for inhalation therapy, the procedure was carried out once a day, in the daytime (until 17:00) in order to avoid unwanted night cough and sputum discharge, the drug was administered at the rate of 0.1 ml / kg / day.

On the effectiveness of the therapy, along with clinical and laboratory-instrumental research methods, the following were used: the scale of respiratory disorders - RDAI, the saturation method - SpO₂ and the modified bronchophonography according to the E:I index method [6], which made it possible to objectively assess the severity of bronchial obstruction. Objective signs of cough and sputum were assessed. The severity of cough in patients was assessed according to a scoring system: 0 points - no cough, 1 point - a single cough, 2 points - moderate cough and 3 points - frequent, painful cough, and sputum discharge was assessed as follows: 0 points - no sputum, 1 point - easy to pass, 2 points - difficult and 3 points - viscous inseparable sputum.

Additional criteria for the effectiveness of therapy were the duration of oxygen therapy and the duration of hospitalization.

Patient management was carried out in accordance with the specifics of the work of the Emergency Medical Service, diagnostic and treatment standards (the recommended deadlines for inpatient treatment of bronchopulmonary diseases were observed). Discharge criteria were: satisfactory condition, SpO₂ ≥ 95%, E:I index < 1.20. The presence of cough, minor auscultatory pathological changes was not a contraindication for discharge. The observation of patients continued until the complete resolution of the main symptoms of the disease.

Statistical processing of the obtained results with the calculation of the arithmetic mean, its error and Student's test was carried out using the statistical software package "Statistica 10.0".

Research results.

As a result of the comparison of clinical signs in patients of the compared groups, upon admission to the hospital, there were no statistically significant differences in the main clinical, laboratory and instrumental parameters. The indicators given in Table 1 indicate the need for hospitalization and urgent medical and diagnostic measures.



Table 1 Main indicators of patients with recurrent obstructive bronchitis upon admission to the hospital (M±m)

No.	Parameters (points)	I group	II group	R
1	Cough	1.8±0.1	1.8±0.2	>0.5
2	Sputum	1.8±0.1	1.8±0.1	>0.5
3	Wheezing wheezing during inhalation	1.2±0.1	1.1±0.1	>0.5
4	Wheezing wheezing during exhalation	1.8±0.1	1.8±0.1	>0.5
5	Number of lung fields involved	1.7±0.1	1.6±0.1	>0.5
6	Indrawings of the subclavian spaces	1.3±0.1	1.4±0.1	>0.5
7	Indrawings of the intercostal spaces	1.4±0.1	1.3±0.1	>0.5
8	Indrawings of the hypochondria	1.2±0.1	1.3±0.1	>0.5
9	SpO2 (%)	94.1±1.2	94.4±1.0	>0.5

Note: P - significance of differences between groups I and II.

The conducted study aimed at studying the differences in the dynamics of the elimination of the main clinical manifestations of the disease (Table 2) showed that in patients of the compared groups there were significant differences in the timing of the elimination of all the main clinical symptoms. Thus, the normalization of the general condition occurred 1.0 days faster in patients in whose ward nebulizer therapy with 10% acetylcysteine solution was carried out in comparison with patients from the comparison group (P<0.01). The elimination of respiratory failure, as well as additional signs of respiratory failure (disappearance of cyanosis, tachypnea) also directly depended on inhalation therapy with acetylcysteine, namely, this syndrome was eliminated much faster when using the method we proposed, therefore, these symptoms were eliminated significantly faster in patients of group I compared with patients of group II (P<0.001). The cough reflex also depended on the use of inhaled mucolytic therapy, so this symptom was eliminated faster in patients of group I on average by 1.4 days, resolving faster in comparison with patients of group II (P<0.01).

Table 2. Comparative analysis of the dynamics of the elimination of the main clinical symptoms in the compared groups

No.	Indicators	I group (main)		II group (comparisons)		P
		M	m	M	m	
1	State normalization	4.5	0.2	5.5	0.3	<0.01
2	Disappearance of cyanosis	4.2	0.2	5.5	0.4	<0.001
3	Cough relief	5.0	0.4	6.4	0.4	<0.01
4	Respiratory failure	2.5	0.2	3.4	0.2	<0.001
5	Physical changes in the lungs	4.0	0.3	5.7	0.3	<0.001
6	Tachypnea	3.1	0.2	4.3	0.2	<0.001



P - reliability of differences in the compared indicators of the studied groups

A comparative analysis of the dynamics of changes in the cough reflex (Table 3) showed the effectiveness of the use of nebulizer inhalations of 10% acetylcysteine. So, if at admission cough was observed with approximately the same intensity in patients of both groups, then starting from the 3rd day of the proposed nebulizer therapy, there was a statistically significant decrease in the intensity of cough in patients of group I compared with patients of group II. At the same time, a significant difference in the use of acetylcysteine over the standard therapy for the disease continued to manifest itself by 4-6 ($P < 0.01$; $P < 0.001$).

Table 3. Comparative analysis of the dynamics of the cough reflex in patients in the compared groups

No.	Days of hospitalization	I group (main)		II group (comparisons)		P
		M	m	M	m	
1	1 day	1.8	0.1	1.8	0.2	>0.5
2	2 day	1.6	0.1	1.7	0.1	>0.5
3	3 day	1.3	0.1	1.6	0.1	<0.05
4	Day 4	1.0	0.1	1.4	0.1	<0.01
5	Day 5	0.8	0.04	1.2	0.1	<0.01
6	Day 6	0.6	0.03	0.9	0.05	<0.01

Note: P - significance of differences between groups I and II

Comparative analysis also showed a positive trend in the use of nebulizer inhalations of acetylcysteine in the study of sputum discharge (table 4). So, if upon admission, sputum with varying severity of cough was difficult to pass, then already starting from the 2nd day of mucolytic therapy, most children had a "productive" cough with sputum discharge. At the same time, a significant difference in the use of acetylcysteine over the standard therapy for the disease continued to manifest itself on subsequent days of inpatient treatment ($P < 0.01$; $P < 0.001$).



Table 4. Comparative analysis of the dynamics of the cough reflex in patients in the compared groups

No.	Days of hospitalization	I group (main)		II group (comparisons)		P
		M	m	M	m	
1	1 day	1.8	0.1	1.8	0.2	>0.5
2	2 day	1.4	0.1	1.7	0.1	<0.05
3	3 day	1.1	0.1	1.5	0.1	<0.01
4	Day 4	0.9	0.06	1.3	0.1	<0.01
5	Day 5	0.6	0.03	1.1	0.1	<0.001
6	Day 6	0.5	0.02	0.9	0.05	<0.001

Note: P – significance of differences between groups I and II

The study of the dynamics of the E:I index (table 5) shows that in patients of the 1st group who received nebulizer inhalations of 10% acetylcysteine, a more pronounced positive effect was observed in comparison with patients of the 2nd group. A significant difference in the indicator of bronchial obstruction was observed on average from day 2 of therapy until the end of the observation.

Table 5 Dynamics of E:I index in the studied groups (M±m)

Observation groups	1 day	2 day	3 day	Day 4	Day 5	Day 6
I group	1.58±0.10	1.42±0.07	1.27±0.07	1.17±0.06	1.12±0.04	1.09±0.05
II group	1.62±0.11	1.55±0.08	1.48±0.05*	1.38±0.04*	1.30±0.03*	1.25±0.03*

Note: * - P<0.05 - significance of differences in group I in comparison with group II.

The use of nebulizer inhalations with acetylcysteine led to a significant (P<0.05; P<0.01) reduction in the duration of oxygen therapy, a reduction in inpatient treatment of patients by an average of 0.3 and 0.9 days in patients of group II compared with patients who received standard therapy for the disease (table 6).



Table 6 Comparative characteristics of the duration of oxygen therapy and hospitalization in children of the observed groups (M±m)

Indicators	Group I	Group II	R
Duration of oxygen therapy (days)	1.1±0.1	1.4±0.1	<0.05
Duration of hospitalization (bed days)	5.3±0.3	6.2±0.3	<0.01

Note: P-significance of differences between groups I and II.

The study of the effectiveness of the nebulizer application of a 10% solution of acetylcysteine was not accompanied by significant side effects, which correlated well with the high level of safety of the drug.

Conclusion. Thus, the use of nebulizer inhalations of a 10% solution of acetylcysteine in recurrent obstructive bronchitis in children helps to reduce the intensity and duration of cough, sputum viscosity, and leads to a significant decrease in the severity of bronchial obstruction according to E:I index. The use of the drug causes a decrease in the duration of oxygen therapy and the duration of inpatient treatment, which makes it possible to recommend the use of this method in the treatment of the disease.

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