

THE USAGE OF HALOAEROSOL THERAPY IN THE REHABILITATIONAL TREATMENT OF CHILDREN WITH RECURRENT BRONCHITIS

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Abstract

Aim. Comparative evaluation of the effectiveness of various therapeutic complexes on the basis of haloaerosoltherapy in the rehabilitational treatment of children with recurrent bronchitis on the ground of clinical and functional data and further development of recommendations for differentiated treatment.

Objectives. Children (at the age of 6-10 years) with recurrent bronchitis, who received treatment in conditions of artificial rock salt aerosol medium (haloaerosoltherapy).

Material and Methods. 35 children with recurrent bronchitis (RB) were examined. All children's clinical data were monitored; respiratory function was evaluated using spirometry. Forced inspiratory vital capacity (FIVC), forced expiratory volume for the 1-st second (FEV_1), peak expiratory flow (PEF), forced expiratory flow at the point of 25% from FIVC (FEF_{25}), forced expiratory flow at the point of 50% from FIVC (FEF_{50}), and forced expiratory flow at the point of 75% from FIVC (FEF_{75}) were defined.

The patients were treated with the help of two therapeutic complexes (TC). 12 children were treated by the first TC which included haloaerosoltherapy (14 procedures), in well-equipped room with the initial concentration of rock salt aerosol 40 mg/m^3 and the predominance of fine powder fraction ($<80\%$). The first procedure lasted 10 minutes, the second – 20 minutes, the third and the following ones – 30 minutes. The concentration and dispersity of haloaerosol were measured with the help of special laser optical system. 23 children underwent second TC, which included 12 procedures of singlet oxygen therapy in the form of foam additionally to the haloaerosoltherapy sessions.

Results. At the beginning of the treatment children had no signs of the acute phase of the disease. Though there were some symptoms which testify that the inflammatory process and functional recovery are not finished yet after the acute phase of the recurrent bronchitis. The clinical picture was confirmed by the major indices of respiratory function (RF). It should be noted that several indices which characterize the bronchial permeability, especially small ones were lowered.

After treatment clinical symptoms in the majority of patients were normalized. At the same time, some peculiarities of the effectiveness of the treatment were revealed at patients treated using different TCs.

The positive dynamics of clinical signs of the disease was also testified by the valuable growth of RF indices. It has to be noted that there was no distinct difference between groups in the RF outcoming data. But TC-2 usage has led to statistically better improvement of integral indices and indices which characterize the bronchial permeability.

Conclusions.

Children with RB which are in non-acute phase of the disease can have some clinical symptoms which testify the incompleteness of the inflammation process confirmed by the decrease of RF indices, which characterize the permeability of middle and small bronchi.

The rehabilitational treatment, which medium positively influences the clinical is based on the use of rock salt aerosol

duration of RB at children and promotes improvement of RF indices.

Complex rehabilitation with the use of haloaerosoltherapy and oxygen therapy in the form of foam has a more pronounced positive effect on the clinical symptoms and is testified by more significant dynamics of RF indices.

The usage of artificial aerosol medium at children with RB is accompanied with insignificant and mild balneal reaction (in a form of rhinitis, cough intensification) in 25,7% of cases, predominantly from the 4th to 10th treatment session. This balneal reaction could be explained by hyperosmolar stimulation of the upper respiratory tract mucous and tracheo-bronchial tree.

Key words: children, recurrent bronchitis, haloaerosoltherapy, respiratory function.

Introduction. The most widespread kinds of diseases among Ukrainians, both adults and children, are respiratory diseases; the disease prevention and treatment aren't much effective [1, 3]. The possibility of recurrent pathology of bronchopulmonary system to become chronic focuses our attention on it. A lot of authors noticed various deviations which continue to persist in the intercurrent period and the abundant quantity of medicine can suppress the defensive mechanisms. That is why we need complex approach to prevent the irreversible changes.

In this context, non-medical methods of treatment are preferable, which can restore the immune mechanisms. Haloaerosoltherapy (HAT) is one of these methods. Numerous researches proved its' high therapeutic effect in cases of bronchopulmonary pathology, especially in adults. HAT provides hyperosmolar stimulation, intensifies mucolytic clearance, and has a bactericidal effect and indirect rehabilitational effect on the immune system [2]. HAT in complex with

other physical factors increases the efficiency of the treatment.

Aim. Comparative evaluation of the effectiveness of various therapeutic complexes on the basis of haloaerosoltherapy in the rehabilitational treatment of children with recurrent bronchitis on the ground of clinical and functional data and further development of recommendations for differentiated treatment.

Materials and methods. 35 children (at the age of 6-10 years) with recurrent bronchitis (RB) were examined. The diagnosis was made upon the condition that bronchitis symptoms were observed twice a year or even more with the duration of each episode no less than 2 weeks.

All children's clinical data were monitored; respiratory function was evaluated using spirometry (complex «CARDIO+», Ukraine). Forced inspiratory vital capacity (FIVC), forced expiratory volume for the 1-st second (FEV₁), peak expiratory flow (PEF), forced expiratory flow at the point of 25% from FIVC (FEF₂₅), forced expiratory flow at the point of 50% from FIVC (FEF₅₀), and forced expiratory flow at the point of 75% from FIVC (FEF₇₅) were defined.

The patients were treated with the help of two therapeutic complexes (TC). 12 children were treated by the first TC which included haloaerosoltherapy (14 procedures), in well-equipped room with the initial concentration of rock salt aerosol 40 mg/m³ and the predominance of fine powder fraction (<80%). The first procedure lasted 10 minutes, the second – 20 minutes, the third and the following ones – 30 minutes. The concentration and dispersity of haloaerosol were measured with the help of special laser optical system. 23 children underwent second TC, which included 12 procedures of singlet oxygen therapy in the form of foam

additionally to the haloaerosoltherapy sessions.

Results.

At the beginning of the treatment children had no signs of the acute phase of the disease. Though there were some symptoms which testify that the inflammatory process and functional recovery are not finished yet after the acute phase of the recurrent bronchitis.

28,6% of patients had stuffed nose, 31,4% had nasal discharge, 22,9% complained about chesty cough and 31,4% - about dry cough. Hyperemia of the throat mucosa was rarely observed (5,7 %). Auscultatory 28,6% of children had harsh breath, 20,0% of observed had slightly harsh breath, 51,4% of patients had vesicular breathing. Dry rales were heard in 29,9% cases and bubbling ones - in 8,6% of cases.

The clinical picture was confirmed by the major indices of respiratory function (RF). It should be noted that several indices which characterize the bronchial permeability, especially small ones were lowered. FEF_{75} was $71,17 \pm 0,82\%$ and FEF_{50} was $75,39 \pm 0,86\%$. That means there is pathological process at the level of distal and central bronchi. The bronchial permeability of the large bronchi was slightly disrupted and the index of FEF_{25} conformed to lower limit of the norm ($79,56 \pm 1,06\%$). At the same time integral indices were at considerably high output level. Before the treatment $FIVC$ was equal to $89,22 \pm 1,17\%$, FEV_1 - $83,25 \pm 1,12\%$ and PEF_{exp} - $89,78 \pm 1,18\%$.

The analysis of clinical functional data before treatment revealed residual inflammation in bronchi of children with RB. This can condition the process chronisation and requires rehabilitative measures.

In the process of treatment balneal reactions were observed in 25,7% of cases.

They were predominantly seen from 4th to 10th day of haloaerosoltherapy and were evident as stuffed nose, the increase of nasal discharge and exasperation of chesty cough. These symptoms didn't need to be specially treated. They can be explained as physiological reaction to hyperosmolar factor which assists rehabilitation.

After treatment clinical symptoms of the majority of children were normalized (tabl. 1).

Though peculiarities of the effectiveness of the treatment were revealed in the groups of patients treated using different TCs.

In particular, bz the end of TC-1 patients didn't have stuffed nose ($p < 0,01$) or nasal discharge ($p < 0,01$). The number of children with chesty cough didn't change (16,7%); this can be considered as the reaction to hyperosmolar stimulation which helps to remove the slime. Though at the end of treatment patients of this group didn't have dry cough ($p < 0,01$).

After TC-2 children didn't have stuffed nose ($p < 0,05$) and there was a rare nasal discharge (4,3%, $p < 0,05$). The cases of chesty cough cases essentially decreased ($p < 0,01$), an imperceptible dry cough was observed in few patients (4,3%; $p \leq 0,01$). In general, cases of cough after TC-1 decreased in 4 times ($p < 0,01$) and after TC-2 - in 6,5 times ($p < 0,001$). The patients treated using TC-1 the auscultatory frequency of vesicular breathing decreased to 91,7% ($p < 0,01$), and after TC-2 - to 95,7% ($p < 0,01$).

The positive dynamics of clinical symptoms of the disease is also confirmed by the valuable growth of RF indices. It has to be noted that there was no distinct difference between groups in the RF outcoming data. At the same time, TC-2 usage has led to statistically better improvement of integral indices and indices which characterize the bronchial permeability (tabl. 2).

Table 1. Clinical children's characteristics before and after treatment

Clinical symptoms	TC-1 (n=12)				TC-2 (n=23)			
	Before treatment		After treatment		Before treatment		After treatment	
	n	%	n	%	n	%	n	%
Stuffed nose:	5	41,7	0	0	4	17,4	0	0
- imperceptible	5	41,7	0	0	4	17,4	0	0
- moderate	0	0	0	0	0	0	0	0
Nasal discharge:	4	33,3	0	0	6	26,1	1	4,3
- imperceptible	4	33,3	0	0	6	26,1	1	4,3
- moderate	0	0	0	0	0	0	0	0
- hydrous	2	16,7	0	0	2	8,7	0	0
- mucous	2	16,7	0	0	4	17,4	1	4,3
Cough:	8	66,7	2	16,7	13	56,5	2	8,7
- chesty	2	16,7	2	16,7	8	34,8	1	4,3
- dry	6	50	0	0	5	21,7	1	4,3
Expectoration:	2	16,7	2	16,7	8	34,8	1	4,3
- occasional	1	8,3	2	16,7	7	30,4	1	4,3
- viscous	1	8,3	0	0	1	4,3	0	0
- mucous	2	16,7	2	16,7	8	34,8	1	4,3
- puromucous	0	0	0	0	0	0	0	0
Hyperemia of mucosa of the throat	0	0	0	0	2	8,7	1	4,3
The type of breathing:								
- vesicular	4	33,3	11	91,7	14	60,9	22	95,7
- with the shade of harshness	0	0	1	8,3	7	30,4	1	4,3
- harsh	8	66,7	0	0	2	8,7	0	0
Wheezing:	7	58,3	0	0	4	17,4	0	0
- dry	6	50	0	0	2	8,7	0	0
- bubbling	1	8,3	0	0	2	8,7	0	0

Table 2. The dynamics of respiratory function indices under the influence of treatment

Index	TC-1 (n=12)			TC-2 (n=23)		
	Before treatment	After treatment	p	Before treatment	After treatment	p
FIVC, %	87,92±2,47	96,75±2,54	<0,05	89,88±1,26	98,19±1,65	<0,001
FEV1, %	82,08±2,48	90,75±2,65	<0,05	83,86±1,17	91,52±1,45	<0,001
PEF _{exp} , %	90,00±2,23	98,50±2,56	≤0,1	91,71±1,27	99,81±1,55	<0,001
FEF ₂₅ , %	77,92±2,25	85,08±2,36	<0,05	80,38±1,11	87,71±1,28	<0,001
FEF ₅₀ , %	73,75±1,84	79,75±1,92	<0,05	76,21±0,89	82,71±1,22	<0,001
FEF ₇₅ , %	69,67±1,73	75,75±1,72	<0,05	71,92±0,86	77,76±1,24	<0,001

Note: p – the faithfulness of index differences before and after treatment.

Clinical and functional data after the treatment testifies the positive effect of haloaerosoltherapy on the respiratory system of children with recurrent bronchitis. This can be seen in the better permeability of bronchial tree on the level of big, middle and small bronchi and in the improvement of respiratory function. At the same time, the combination of haloaerosoltherapy with oxygen therapy in the form of foam leads to the functional recovery of bronchopulmonary system's functions, which could be conditioned by the antioxidant effect of oxygen therapy.

It should be noted that the permeability of small bronchi didn't fully normalized after the treatment. This needs further investigations for the ways of improvement in the rehabilitational treatment of children with RB.

Conclusions

1. Children with RB which are in non-acute phase of the disease can have some clinical symptoms which testify the incompleteness of process of inflammation confirmed by the decrease of RF indices, which characterize the permeability of middle and small bronchi.

2. The rehabilitational treatment, which is based on the use of rock salt aerosol medium positively influences the clinical duration of RB at children and promotes improvement of RF indices.

3. Complex rehabilitation with the use of haloaerosoltherapy and oxygen therapy in the form of foam has a more pronounced positive effect on the clinical symptoms and is testified by more significant dynamics of RF indices.

4. The usage of artificial aerosol medium at children with RB is accompanied with insignificant and mild balneal reaction (in a form of rhinitis, cough intensification) in 25,7% of cases,

predominantly from the 4th to 10th treatment session. This balneal reaction could be explained by hyperosmolar stimulation of the upper respiratory tract mucous and tracheo-bronchial tree.

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