HALOTHERAPY FOR TREATMENT OF RESPIRATORY DISEASES

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ABSTRACT

This work elucidates the questions upon the development of a new drug-free method for respiratory diseases treatment. Halotherapy is a mode of treatments in a controlled air medium which simulates a natural salt cave microclimate. The main curative factor is the dry sodium chloride aerosol with particles of 2 to 5 mkm in size.
Particles density (0.5-9 mg/m³) varies with the type of the disease. Other factors are: comfortable temperature, humidity regime, the bacteriological and allergen-free air environment saturated with the aerosol.

The effect of HT was evaluated in 124 patients (pts) with various types of respiratory diseases. The control group of 15 pts received placebo. HT course consisted of 10-20 daily procedures of 1 hour. HT resulted in improvements of clinical state in the most of the patients. The positive dynamics of flow-volume loop parameters and decrease of bronchial resistance measured by bodyplethysmography were observed. The changes in the control group parameters after HT were not statistically significant.

Data on healing mechanisms of a specific air dispersive environment of sodium chloride while treating the respiratory diseases are discussed.

INTRODUCTION

The considerable increase of allergic diseases and reactions and of other serious complications due to the drug therapy explains the interest of clinicians to the development of drug-free methods of treatment. Halotherapy (“halos” in Greek means salt) is one of such methods. Halotherapy (HT) is a mode of treatments in a controlled air medium which simulates a natural salt cave microclimate.

The treatment in the natural salt caves (Speleotherapy) has been known since long. The efficacy of Speleotherapy is associated with the unique cave microclimate. The natural dry sodium chloride aerosol is the major curative factor of the cave microclimate. It is formed by the convective diffusion of comfortable temperature and humidity regime, the hypo bacterial and allergen-free air environment saturated with aero ions enhancing the therapeutic effect.

A suggestion that it is the air saturated with saline dust that causes the main curative effect in the Speleotherapy of patients with respiratory diseases was first formulated by a Polish physician F. Bochkowsky in 1843. Salt mines are known to be used for therapeutic purposes in other countries such as Austria (Solzbad-Salzetnan), Rumania (Sieged), Poland (Wieliczka), Azerbaijan (Nakhchivan), Kirgizia (Chon-Tous), Russia (Berezniki, Perm region), the Ukraine (Solotvino, Carpathians), Artiomovsk, Donietsk region).

Speleotherapy has been recognized as a highly effective drug-free treatment method. Great experience in the treatment of patients with various forms of chronic nonspecific pulmonary diseases has proved Speleotherapy to be very effective under the conditions of the salt mine microclimate of Solotvino. The therapeutic effect has been proved by the data of biochemical immunological and microbiological research (Simyonka 1989, Slivko, 1980, Yefimova et al, 1990, Zadorozhnaya et al, 1986). It is assumed that during the treatment the organism adapts to the specific features of the microclimate and alters all its functional systems.

However, adaptation of the patients who came from different climate areas, travel and transport problems, and limited number of beds kept back its wide spreading. So HT has been worked out.

DESCRIPTION OF HALOTHERAPY

HT is performed in a special room with salt coated walls - Halochamber. Dry sodium chloride aerosol (DSCA) containing the dominating amount of 2 to 5 mkm particles is produced by a special nebulizer.

<p>| TABLE I |
| Fractions of dry sodium chloride aerosol in Halochamber (According to the data of optical devices) |</p>
<table>
<thead>
<tr>
<th>Size of particles, mkm</th>
<th>Fractions, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>35.4 ± 2.1</td>
</tr>
</tbody>
</table>
TABLE 2
Composition criteria requirements for salt to be used in halotherapy.

<table>
<thead>
<tr>
<th>Chemical composition of salt</th>
<th>% (mass)</th>
<th>Chemical composition of salt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na, not less than</td>
<td>97.70</td>
<td>Fe₂O₃, not more than</td>
</tr>
<tr>
<td>Ca-ion, not more than</td>
<td>0.50</td>
<td>Na₂SO₄</td>
</tr>
<tr>
<td>Mg-ion, not more than</td>
<td>0.10</td>
<td>Water insoluble sediment, not more than</td>
</tr>
<tr>
<td>SO₄-ion, not more than</td>
<td>1.20</td>
<td>Moisture in rock-salt, not more than</td>
</tr>
<tr>
<td>K-ion, not more than</td>
<td>0.10</td>
<td>pH of NaCl solution</td>
</tr>
</tbody>
</table>

The constant level of desirable aerosol mass concentration in the range of 0.5-9 mg/m³ is maintained automatically. Composition of the salt used for HT is shown in the Table 2 (The Russian State Standard is 13830 - 4). The temperature of 18-22 C and 45-55% humidity of the medium are maintained by air conditioning system and heating devices. The HT process and microclimate parameters are controlled with the help of computer.

The treatment in Halochamber is conducted daily, the duration of the procedure is 1.0 hour, and the length of the course is 12-25 days. The duration of each course and the parameters of aerosol medium depend on nosology, clinical features, phase of the disease, etc and are prescribed by the physician (Table 3). The DSCA concentration may be changed during the period of treatments in accordance with the requirements of the changing state.

The patients breathe quietly while reclining in the special armchairs. Therapy is accompanied by musical psycho suggestive program and demonstration of slides, HT is carried out either alone or in association with the base medication and other methods of treatment.

TABLE 3
Concentrations of dry sodium chloride aerosol and duration of halotherapy.

<table>
<thead>
<tr>
<th>Disorders</th>
<th>Specificity</th>
<th>FEV1 (% Pr.)</th>
<th>Concentration (mg/m³)</th>
<th>HT duration (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchial asthma</td>
<td>Allergic</td>
<td>-</td>
<td>0.5-1</td>
<td>12-14</td>
</tr>
<tr>
<td></td>
<td>Infection dependent</td>
<td>&lt;60</td>
<td>0.5-1</td>
<td>1-2</td>
</tr>
<tr>
<td>Chronic obstructive bronchitis</td>
<td>-</td>
<td>&lt;60</td>
<td>0.5-1</td>
<td>18-21</td>
</tr>
<tr>
<td>Chronic nonobstructive bronchitis</td>
<td>-</td>
<td>-</td>
<td>3-5</td>
<td>18-21</td>
</tr>
<tr>
<td>Bronchiectasis</td>
<td>-</td>
<td>&lt;60</td>
<td>1-2</td>
<td>21-25</td>
</tr>
<tr>
<td></td>
<td>&gt;60</td>
<td>7-9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>-</td>
<td>-</td>
<td>3-5</td>
<td>21-25</td>
</tr>
</tbody>
</table>
HT was administrated in a group of 124 patients (54 males and 70 females) aged from 16 to 62 years (mean age 34.3 ± 2.5 years) with various types of chronic nonspecific pulmonary diseases (Table 4). In all of the patients (pts), the disease was in the stage of a prolonged exacerbation. Before the treatments half of them (47%) had been coughing, half of them had severe attacks of coughing with scanty viscous sputum. Most of the pts (81%) suffered from attacks of asthma so that one third of them used combined medication to control it. Auscultation revealed harsh and weakened breathing, and dry rales in 58% of the patients.

60% of the pts received a base therapy (beta-agonists, theophyllines, chromoglycate natrii, corticosteroids, etc.), the effect of which did not allow to achieve a complete remission. The pts had not taken any antibacterial medicine.

The control group was represented by 15 pts (7 females and 8 males) aged from 18 to 56 years (mean age 38.4 ± 1.5 years). Placebo course consisted only of 10 procedures of musical psychosuggestive program with slides demonstration in an ordinary room.

The pts' condition was assessed by daily medical supervision, with functional and laboratory tests made before and after HT, as well as every 7th day during the treatments. Series of examinations in the control group consisted of the tests similar to those for the main group of pts.

**TABLE 4**
The patients studied

<table>
<thead>
<tr>
<th>Disease</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchial asthma</td>
<td>87</td>
</tr>
<tr>
<td>Mild</td>
<td>32</td>
</tr>
<tr>
<td>Moderate</td>
<td>34</td>
</tr>
<tr>
<td>Severe</td>
<td>21</td>
</tr>
<tr>
<td>Chronic bronchitis</td>
<td>26</td>
</tr>
<tr>
<td>Nonobstructive</td>
<td>12</td>
</tr>
<tr>
<td>Obstructive</td>
<td>14</td>
</tr>
<tr>
<td>Bronchiectasis</td>
<td>6</td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>124</strong></td>
</tr>
</tbody>
</table>

Standard method of flow-volume loop was registered by "Pneumoscreen" ("Jager", Germany). The following parameters were assessed: forced expiratory volume of the 1st sec (FEV1), peak expiratory flow (PEF), forced expiratory flow at 50% FVC (FEF50). The character and the extent of bronchial patency impairment were estimated according to predicted values and limits of norm and its deviation (Klement et al, 1986). Dynamics of the parameters and their variability. Inhalation bronchospasmolytic test with 0.4 mg of Berotec was carried out in 56 patients before and after therapy. When the test was positive, the obstructions was considered to be reversible i.e., bronchospastic component was significant in the genesis of obstruction. Airway resistance (Raw) and intrathoracic gas volume (ITGV) were measured by "Bodyscreen" ("Jager", Germany). Total lung capacity (TLC), residual volume (RV) and their ratio (RV/TLC) were calculated on the base of spirography and bodyplethysmography data. Raw analysis was carried out in absolute values, while other parameters were given in predicted values (Kristufec et al, 1979). Diffusion capacity of the lungs by steady state method (DLss) was measured by "Transfersacen" in absolute values and as % of predicted values (Pivotean & Dechouret et al, 1968).

Standard methods of variation statistics were used for group analysis of the material, students' test being used for significant differences in independent and correlated samples.

**RESULTS**
Clinical studies

After 3-5 sessions of HT 70-80% of the pts (according to nosology) presented some improvements: expectoration of good amount of sputum— it was less tenacious and easier to discharge, better auscultator pattern of the lungs, less frequent occurrence of cough attacks or respiratory discomfort. Some pts with bronchial asthma (BA) (35 patients - 27% of the total number) experienced difficulty in bringing up the phlegm and worsening of cough during 3-4 days. These manifestations seem to be due to the temporal bad bronchial drainage resulting from hyper secretion of mucus and discharge of old clots of secretion. Expiratory dyspnea appeared or became more pronounced in 18 patients (15% or cases) at different periods of HT. Those were pts with severe and moderate bronchial asthma and aspirin-induced asthma. None of the pts complained of bad condition during the HT procedures.

By the end of the course of HT all the pts felt better they slept well, had no fatigue or weakness, and their nervous system stabilized. It was shown that the number of asthma attacks and respiratory discomfort cases decreased significantly as compared to the initial ones (81% and 52%, respectively, p<0.001). The number of asthma attacks controlled by combined medication also decreased (32% and 2%, respectively, p<0.001).

The cases of cough occurred more rarely (95% and 70%, respectively, p<0.001), cough became easier and more productive, turned mucousal. The number of the patients with signs of vasomotor rhinitis decreased (61% and 24%, respectively p<0.001).

Corticosteroids were discontinued in 50 % (11 pts) of the pts with corticosteroid therapy (22 pts). Those were the cases when inhaled corticosteroids were prescribed as anti-inflammatory agents. In 7 pts it was possible to reduce the dose, 41 pts (60% of pts who inhaled beta- agonists) were able to discontinue beta-agonists. Reduction (or cancellation) in bronchodilator and inhaled corticosteroid consumption was an indicator of clinical benefit.

The clinical state of 85% of the pts with mild and moderate BA, 75 % with severe BA, 98%- with chronic bronchitis, bronchiectasis and cystic fibrosis improved after HT. The pts were examined 6 and 12 months after the first HT course. No aggravations of the disease were seen from the 3d to the12th month. The average duration of the remission was 7.6-0.9 m. Most of the pts (60%) used no medication and sought no medical advice.

Lung function studies

Before HT bronchial obstruction was found in 83 pts (67% of all cases), 1/3 of them (25 pts) had marked impairment. By the end of the course bronchial obstruction was found in 50% of the pts but the numbers of cases with marked impairment were diminished (16 pts) (Fig.1).

Direct effect of a HT procedure on bronchial potency was studied in 12 pts. The difference between the average flow-volume loop parameters in the group after 1 procedure was insignificant (p>0.05) when compared to the initial values.

Individual analysis showed that 5 pts had a significant increase of the parameters, a decrease was seen in 4 pts and in 3 cases there were no changes. On the basis of these data it is impossible to estimate the real action of DSCA on bronchial patency.

The patients showed significant increase of FVC, FEV1, PEF, FEF50 by the 7th day, of FVC and FEF50 by the 14th day and of FVC, VC and PEF by the end of HT (Table 5). There was no difference in the extent of the parameter changes after the 7th day and by the end of the treatment.

FIGURE I. Bronchial obstruction before and after the halotherapy (number of patients - 124)
**TABLE 5**

Change of flow-volume loop parameters at various terms of halotherapy (Mean ± SE)

<table>
<thead>
<tr>
<th>Parameter, % baseline</th>
<th>Treatment</th>
<th>7 days</th>
<th>14 days</th>
<th>End of course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td></td>
<td>115</td>
<td>98</td>
<td>124</td>
</tr>
<tr>
<td>VC</td>
<td>0 ± 0.9</td>
<td>2 ± 1.3</td>
<td>2 ± 0.9*</td>
<td></td>
</tr>
<tr>
<td>FVC</td>
<td>2 ± 0.9*</td>
<td>3 ± 1.3*</td>
<td>2 ± 1.0*</td>
<td></td>
</tr>
<tr>
<td>FEV1</td>
<td>3 ± 1.2*</td>
<td>3 ± 1.6</td>
<td>2 ± 1.3</td>
<td></td>
</tr>
<tr>
<td>PEF</td>
<td>4 ± 1.4*</td>
<td>3 ± 1.9</td>
<td>3 ± 1.2*</td>
<td></td>
</tr>
<tr>
<td>FEF 50</td>
<td>7 ± 1.5*</td>
<td>7 ± 2.9*</td>
<td>2 ± 2.0</td>
<td></td>
</tr>
</tbody>
</table>

*significant (p< 0.05, here and further) changes vs initial values (paired t-test)

Findings of bodylethysmography and diffusion capacity of the lungs are given in Table 6. After the HT there was a significant decrease in Raw and RV/TLC, other parameters changes were insignificant.

To know whether the initial extent of obstruction had any effect on the dynamics of bronchial patency during HT all pts were divided into four groups according to the extent of obstruction (Table 7). Group I included patients with normal indices of forced expiration (FEF 50>62%Pr.); group II - with mild impairment of bronchial patency (FEF50<51%Pr.); group III - with moderate (FEF50<31%Pr.), and group IV - with severe obstruction (FEF50<22%Pr.)

**TABLE 6**

<table>
<thead>
<tr>
<th>Parameter, (% baseline)</th>
<th>Treatment</th>
<th>before</th>
<th>after</th>
</tr>
</thead>
<tbody>
<tr>
<td>VC</td>
<td>99 ± 3</td>
<td>102 ± 3</td>
<td></td>
</tr>
<tr>
<td>ITGV</td>
<td>141 ± 4</td>
<td>133 ± 5</td>
<td></td>
</tr>
<tr>
<td>RV</td>
<td>156 ± 6</td>
<td>139 ± 7</td>
<td></td>
</tr>
<tr>
<td>TLC</td>
<td>111 ± 2</td>
<td>109 ± 3</td>
<td></td>
</tr>
<tr>
<td>RV/TLC</td>
<td>142 ± 5</td>
<td>126 ± 6*</td>
<td></td>
</tr>
<tr>
<td>Raw*</td>
<td>0.37 ± 0.04</td>
<td>0.28 ± 0.02*</td>
<td></td>
</tr>
<tr>
<td>DLss</td>
<td>83 ± 7</td>
<td>79 ± 4</td>
<td></td>
</tr>
</tbody>
</table>

* in kPa/l/s
* significant differences as compared to "before"

**TABLE 7**

Dynamics of bronchial obstruction indices at the end of halotherapy as compared to the initial extent of obstruction (M ± SE).
### Table

<table>
<thead>
<tr>
<th></th>
<th>FEF 50 &gt; 62%</th>
<th>FEF 50 &lt; 51%</th>
<th>FEF 50 &lt; 31%</th>
<th>FEF 50 &lt; 22%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC</td>
<td>41</td>
<td>31</td>
<td>27</td>
<td>25</td>
</tr>
<tr>
<td>FVC</td>
<td>-1 ± 1.1</td>
<td>1 ± 1.3</td>
<td>8 ± 2.5*</td>
<td>14 ± 4.9°</td>
</tr>
<tr>
<td>FEV1</td>
<td>-1 ± 1.2</td>
<td>0 ± 1.4</td>
<td>5 ± 2.9</td>
<td>14 ± 4.9°</td>
</tr>
<tr>
<td>PEF</td>
<td>-3 ± 1.3</td>
<td>0 ± 1.9</td>
<td>7 ± 4.2°</td>
<td>25 ± 8.1°</td>
</tr>
<tr>
<td>FEF 50</td>
<td>1 ± 1.6</td>
<td>-1 ± 1.9</td>
<td>4 ± 4.2</td>
<td>37 ± 10.6°</td>
</tr>
<tr>
<td></td>
<td>-3 ± 2.9</td>
<td>-1 ± 3.7</td>
<td>22 ± 9.0**</td>
<td>33 ± 11.5°</td>
</tr>
</tbody>
</table>

* Significant changes as compared to the initial values
° significant difference from groups I and II
x significant difference from groups III.

At the end of HT the indices in groups I and II did nor differ from the initial ones. In group III values of FEF 50 became significantly increased. The extent of changes of group IV indices was significantly greater than of groups I and II. Similar findings were found on the 7th and 14th day of HT. Irrespectively of the therapy duration the greatest dynamics in bronchial patency were found in group IV (severe obstruction), and no dynamics were seen in groups I and II (slight or no obstruction).

Relationship between the character of obstruction disorders and the changes in indices during the course of therapy were studied. In the broncholytic tests the pts were divided into two groups: those with reversible and irreversible obstruction. By the end of HT no significant differences were found (p>0.05). Both in the presence of bronchospasm and its absence the efficacy of HT on bronchial patency was the same.

### Control group

One-two days after beginning of the therapy many placebo pts (80%) felt better and slept normally which seemed to be associated with psychotherapeutic effects. However, no objective improvement in their lung auscultation picture was noted. There were no significant changes of flow-volume loop parameters as compared to initial values after the course of placebo (VC - -3 ±5.0; FVC - -3 ±4.3; FEV1 - -3 ±3.4; PEF - -6 ±2.6; FEF 50 - -2 ±3.8).

At the same time, 20% of pts with prevailing allergic mechanism of the disease had positive dynamics of function values which was probably associated with no exposure to allergens.

**DISCUSSION**

The course of HT resulted in improvements of clinical state in the most pts. In the overwhelming majority of cases, the number and intensity of asthma attacks and respiratory discomfort decreased or disappeared, which allowed, in a number of cases, to cancel or reduce the dosage of beta-agonists. This was associated with symptoms indicative of a better drain function of their airways: sputum secretion alleviates, it becomes less viscous, coughing relieves, and the auscultative picture of the lungs alters. The difficulty in bringing up the phlegm and worsening of cough during 3-4 days seemed to be due to the temporary hypersecretion of mucus and discharge of old clots of secretion from bronchi of smaller diameter.

The similar clinical results were obtained in other investigations. Efficacy of this method has been noted in pts with various pathogenic variants of BA, chronic bronchitis, bronchiectasis, upper airways diseases, etc. (Alexandrov & Chervinskaya et al, 1994, Chervinskaya et al, 1993, 1994, Norvaishas et al, 1992, Pokhaznikova et al, 1992, Telyatnikova et al, 1992, Tikhomirova et al, 1993).

In our investigation the improvement in the clinical state of pts was accompanied by positive dynamics of the functional measurements of bronchial patency which started on the 7th day and persisted to the end of the course. There was no direct bronchospasmolytic effect. The dynamics of bronchial patency depended upon the initial extent of obstruction: the more marked was the bronchial obstruction, the better were the results of HT. This was particularly evident in severe obstruction (reversible or irreversible).

Thus, clinical functional results suggest, that HT has gradual positive influence on bronchial obstruction. With this mode of therapy
The evaluation of brush samples from nosopharynx mucosa in HT showed that the average amount of neutrophils, macrophages and lymphocytes has decreased (Konovalov et al, 1990). The index of epitheliocyte infection with pneumococci and that of adhesion the average number of pneumococci per one affected epitheliocyte have been diminished. Thus, sodium chloride aerosol has bactericidal and bacteriostatic effects on the respiratory airways microflora and prevents the infection of the mucosa (Simyonka, 1989, Rein & Mandell, 1973). The intensity of this action depends on the concentration of the aerosol that causes dehydration of microbial cells and the impairment of the albuminous structure of the cells killing the microorganisms. Another mechanism is possible which causes adhesion of small particles of salt to microbial bodies. As their mass grows, they precipitate rapidly.

However, it is known, that sodium chloride aerosol is an osmolar stimulus, and it can result in the airways hyperactivity (Schoeffel et al, 1981). Several mechanisms of influence are associated with humidification (Linker, 1982). Thus, sodium chloride aerosol with predominance amount of particles of 2 to 5 mkm in size. Such particles can penetrate deep into the smallest airways.

The experiments show that low doses of DSCA have a beneficial effect on phagocytic activity of alveolar macrophages (Konovalov et al, 1990). Higher negative charge of particles is of therapeutic significance as well (Afanasyev, 1990). The study of aerodisperse environments of halochamber allowed to establish that the negative volumetric charge of dry aerosol particles was considerable (6-10 nK/m3) (Wurtemberger et al, 1987). In addition, sodium chloride is the main component of the airway surface liquid, the mucus layer and the periciliary fluid, it is needed for normal functioning of bronchial ciliary epithelium (Wetch M.J., 1987). According to the evidence of certain authors, the amount of sodium chloride in bronchial secretions in patients with chronic pulmonary pathology is lower (Brogan et al, 1971). It is possible, that inhalation of this chemical compound compensates for its deficit in the lungs and improves functioning of bronchial ciliary epithelium (Wrench M.J., 1987). The negative charge of sodium chloride aerosol inhalation challenge is used for diagnosing hyperactivity of the airways. Hypotonic (less than 0.9%) or hypertonic (2-5%) solutions of sodium chloride are usually employed. When the inhalator production is 1 ml per minute, 20 mg of sodium chloride (measured as a dry substance) gets into the airways during 1st min of the challenge test with 2% solution and the amount reaches 50 mg in case of 5% solution. Compare: during a minute session of HT 0.05- 0.10 mg of dry sodium chloride penetrates into the patient's airways when the concentration in the Halochamber is 5 mg/m3. Sodium chloride aerosol in low concentration does not affect the airway mucosa (Konovalov et at, 1990). Higher negative charge of particles is of therapeutic significance as well (Afanasyev, 1990).

In summary, theoretical prerequisites and the data of clinical functional studies obtained allow to suggest that the efficacy of HT results from the combination of the curative properties of sodium chloride aerosol and the way of its administration. At the same time HT mechanisms of influence are not yet studied well enough, and this fact requires continuation of the research.
REFERENCES


[Halotherapy in combined non-puncture therapy of patients with acute purulent maxillary sinusitis]

[Article in Russian]

Grigor'eva NV.

Halotherapy was applied for non-puncture treatment of 45 patients with acute purulent maxillary sinusitis. The response was evaluated on the basis of clinical, immunocytological, x-ray and bacteriological parameters. Halotherapy was found effective in the treatment of acute purulent maxillary sinusitis.

PMID: 13677023 [PubMed - indexed for MEDLINE]
**Efficacy of therapeutic use of ultrasound and sinusoidal modulated currents combed with halotherapy in patient with occupational toxic-dust bronchitis**

Roslaia NA, Likhacheva EI, Shchekoldin PI.

Immunological and cardiorespiratory characteristics were studied in 88 alloy industry workers with occupational toxic-dust bronchitis who received the following therapy: sinusoidal modulated currents (SMC), ultrasound (US) on the chest, halotherapy (HT) (52 patients, group 1); SMC HT (10 patients, group 2); US HT (15 patients, group 3); HT (11 patients, group 4). The patients did also therapeutic exercise and were massaged (chest). It was found that device physiotherapy (SMC, US) in combination with HT raise the treatment efficacy to 86.5%. This combined treatment is recommended both for treatment and prevention of obstructive syndrome.

PMID: 11530404 [PubMed - indexed for MEDLINE]

**Effects of halotherapy on free radical oxidation in patients with chronic bronchitis**

Farkhutdinov UR, Abdrakhmanova LM, Farkhutdinov RR.

Registration of luminol-dependent chemoluminescence of blood cells and iron-induced chemoluminescence of the serum was used to study generation of active oxygen forms and lipid peroxidation in patients with chronic bronchitis (CB). 49 patients with lingering CB showed inhibition of blood cell function and enhancement of lipid peroxidation. The addition of halotherapy to combined treatment of these patients promoted correction of the disorders and improvement of CB course.

Publication Types:
* Clinical Trial

PMID: 11210350 [PubMed - indexed for MEDLINE]

**Effectiveness of halotherapy of chronic bronchitis patients**

Abdrakhmanova LM, Farkhutdinov UR, Farkhutdinov RR.

The chemoluminescence test in 49 patients with lingering inflammatory chronic bronchitis has revealed inhibition of generation of active oxygen forms in the whole blood, intensification of lipid peroxidation in the serum, depression of local immunity. Administration of halotherapy to the above patients results in correction of disturbances of free-radical oxidation, improves local immunity and clinical course of the disease.

PMID: 11197648 [PubMed - indexed for MEDLINE]

**The scientific validation and outlook for the practical use of halo-aerosol therapy**

Chervinskaia AV.

The paper describes a new medical technique--halo-aerosol therapy, the main acting factor of which is dry highly dispersed aerosol of sodium chloride in natural concentration. Halo-aerosol therapy represents a new trend in aerosol medicine. It includes two methods: halotherapy and halo-inhalation. Biophysical and pathophysiological foundations of the new method, how it can be realized are outlined. Clinical reasons are provided for application of halo-aerosol therapy for prevention, treatment and rehabilitation of patients with respiratory diseases. Characteristics and differences of the two halo-aerosol therapy variants are analyzed.
Halotherapy proved to be a highly effective method in a complex sanatorium treatment of patients with chronic bronchitis. Its use promotes more rapid liquidation of clinical manifestations of disease, improves indices of vent function of lungs, especially those values that characterize bronchial conduction (volume of forced exhalations per second, index Tiffno), increases tolerance to physical load, normalizes indices of reduced immunity and leads to increasing the effectiveness of patient treatment in sanatorium.

Halotherapy was used for sanatorium rehabilitation in 29 patients with chronic obstructive pulmonary diseases (chronic bronchitis and asthma). Significant positive effects of this method resulted in the improvement of the flow-volume parameters curve of lung function and in hypotensive effects on blood pressure. Halotherapy is recommended for use in patients suffering from chronic obstructive pulmonary diseases with hypertension or coronary heart disease.

This work elucidates the questions upon the development of a new drug-free method of a respiratory diseases treatment. Halotherapy is mode of treatment in a controlled air medium which simulates a natural salt cave microclimate. The main curative factor is dry sodium chloride aerosol with particles of 2 to 5 mkm in size. Particles density (0.5-9 mg/m3) varies with the type of the disease. Other factors are comfortable temperature-humidity regime, the hypobacterial and allergen-free air environment saturated with aeroions. The effect of HT was evaluated in 124 patients (pts) with various types of respiratory diseases. The control group of 15 pts received placebo. HT course consisted of 10-20 daily procedures of 1 hour. HT resulted in improvements of clinical state in the majority of patients. The positive dynamics of flow-volume loop parameters and decrease of bronchial resistance measured by bodyplethysmography were observed. The changes in control group parameters after HT were not statistically significant. The specificity of this method is the low concentration and gradual administration of dry sodium chloride aerosol. Data on healing mechanisms of a specific airdispersive environment of sodium chloride while while treatment the respiratory diseases are discussed.
18 bronchial asthma (BA) patients (12 with mild and 6 with moderate disease) were examined before and after halotherapy (HT) for airways reactivity using provocative tests with ultrasonic inhalations of purified water (UIPW) and hypertonic salt solution (HSS). Bronchial hyperreactivity (BHR) to UIPW and HSS before treatment occurred in 13 and 11 patients (72 and 69%, respectively). HT reduced BHR in 2/3 and 1/2 of the patients, respectively. In the rest patients BHR was unchanged or increased, being so only in patients with atopic asthma in attenuating exacerbation. Clinical efficacy of HT and initial BHR to UIPW correlated ($r = 0.56$; $p < 0.05$). No correlation was found between HT efficacy and initial BHR to HSS.

PMID: 9019826 [PubMed - indexed for MEDLINE]


[The use of halotherapy for the rehabilitation of patients with acute bronchitis and a protracted and recurrent course]

Halotherapy was used for rehabilitation in 25 patients with acute bronchitis of long-standing and recurrent types. The main therapeutic action was ensured by aerodispersed medium saturated with dry highly dispersed sodium chloride aerosol, the required mass concentration being maintained in the range of 1 to 5 mg/m$^3$. Therapy efficacy was controlled through assessment of clinical, functional, immunological and microbiological findings. Metabolic activity values were taken into consideration as well. Positive dynamics of the function indices in the clinical picture resulted from elimination of pathogenic agents, control of slowly running inflammatory processes and stimulation of some immune system factors. Favourable changes in metabolic activity were present: normalization of serotonin excretion, marked decrease of unbalance in lipid peroxidation-antioxidant system.

PMID: 7785211 [PubMed - indexed for MEDLINE]


[The efficacy of speleotherapy in atopic dermatitis in children]

After proper clinical and immunological examinations 112 children with atopic dermatitis underwent immunocorrective speleotherapy created with the use of natrium chloride spraying. During the treatment positive trends were observed in the patients' dermatological status and immune homeostasis. A complete 6-24-month response was reported in 58%, partial in 20%, no response in 6.9% of patients. The method is recommended for treatment of atopic dermatitis.

PMID: 7846884 [PubMed - indexed for MEDLINE]
ABSTRACT

A substantive amendment to this systematic review was last made on 01 February 2000. Cochrane reviews are regularly checked and updated if necessary.

**Background:** The lung disease in cystic fibrosis is characterized by impaired mucociliary clearance, recurrent bronchial infection and airway inflammation. Hypertonic saline has been shown to enhance mucociliary clearance in vitro and this may act to lessen the destructive inflammatory process in the airways.

**Objectives:** To determine if nebulised hypertonic saline treatment improved lung function, exercise tolerance, quality of life and decreased respiratory infections in patients with cystic fibrosis.

**Search strategy:** Studies were identified from the Cochrane Cystic Fibrosis and Genetic Disorders Group trials register. Titles and abstracts were reviewed to identify all controlled trials. Reviewed articles and bibliographies identified from this process were surveyed for additional citations & RCTs. Identification of unpublished work was obtained from abstract books from the three major Cystic Fibrosis conferences (International Cystic Fibrosis Conference, The European Cystic Fibrosis Conference and the North American Cystic Fibrosis Conference). Trial authors were contacted for additional information when only abstracts were available.

Date of the most recent search of the Group's specialized register: February 2000.

**Selection criteria:** All controlled trials that assessed the effect of hypertonic saline compared to placebo or other mucolytic therapy, for any duration or dose regimen in subjects with cystic fibrosis of any age or severity were reviewed. Studies in languages other than English were included.

**Data collection and analysis:** All identified trials were independently reviewed by both reviewers & all data collected. Trial quality was evaluated using assessment of allocation concealment & the Jadad scale of methodological quality.

**Main results:** Twelve controlled trials of hypertonic saline were identified. Seven trials met the inclusion criteria; these involved 143 subjects with an age range of 6 to 46 years. Of these, six were published studies and one in abstract form. The durations of the trials were limited to immediate effects on mucociliary clearance to a maximum of three weeks.

In two studies, involving thirty five subjects, a score for the feeling of cleared chest was made using visual analogue scales. This analysis showed a weighted mean difference of -0.98 (95% Confidence Interval -1.6, -0.34), favouring hypertonic saline over isotonic saline.

In two trials with 22 subjects hypertonic saline improved mucociliary clearance as measured by isotope clearance from the lungs in 90 minutes demonstrating a weighted mean difference of -11.3 (95% CI -18.6, -4.0), and as area under the clearance time curve; weighted mean difference of -212 (95% CI -272, -152), also favouring hypertonic saline over isotonic saline.

Lung function as measured by improvement in FEV1 was observed in one study of 27 subjects. The percentage increase in FEV1 at two weeks increased by a mean 15.0% with hypertonic saline and 2.8% with isotonic saline (p=0.004).

Adverse events were adequately described in only one trial and none were serious.

**Reviewers’ conclusions:** Nebulised hypertonic saline improves mucociliary clearance immediately after administration which may have a longer term beneficial effect in cystic fibrosis.

The maximum time data were recorded for was only three weeks. Most of the patients had mild to moderate lung disease and the effect on severe lung disease remains unclear.
Further studies of hypertonic saline should be carried out to determine the effect on pulmonary function tests, quality of life, frequency of exacerbations of respiratory disease and efficacy comparisons with nebulised deoxyribonuclease, with larger numbers and for longer duration.

At this stage there is insufficient evidence to support the use of hypertonic saline in routine treatment for patients with cystic fibrosis.

**Citation:** Wark PAB, McDonald V. Nebulised hypertonic saline for cystic fibrosis (Cochrane Review). In: The Cochrane Library, 1, 2001. Oxford: Update Software.

**MeSH:** Administration, Inhalation; Cystic Fibrosis/*drug therapy; Human; Nebulizers and Vaporizers; Saline Solution, Hypertonic/administration & dosage/*therapeutic

This is an abstract of a regularly updated, systematic review prepared and maintained by the Cochrane Collaboration. The full text of the review is available in The Cochrane Library (ISSN 1464-780X).

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Inhalation Aerosols

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**Efficacy of daily hypertonic saline nasal irrigation among patients with sinusitis: a randomized controlled trial.**

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**Objectives:** To test whether daily hypertonic saline nasal irrigation improves sinus symptoms and quality of life and decreases medication use in adult subjects with a history of sinusitis.

**Study design:** Randomized controlled trial. Experimental subjects used nasal irrigation daily for 6 months.

**Population:** Seventy-six subjects from primary care (n=70) and otolaryngology (n=6) clinics with histories of frequent sinusitis were randomized to experimental (n=52) and control (n=24) groups.

**Outcomes measured:** Primary outcome measures included the Medical Outcomes Survey Short Form (SF-12), the Rhinosinusitis Disability Index (RSDI), and a Single-Item Sinus-Symptom Severity Assessment (SIA); all 3 were completed at baseline, 1.5, 3, and 6 months. Secondary outcomes included biweekly assessment of symptoms and medication use. At 6 months, subjects reported on side effects, satisfaction with nasal irrigation, and their sinus-related quality of life.

**Results:** No significant baseline differences existed between the 2 groups. Sixty-nine subjects (90.8%) completed the study. Compliance averaged 87%. Experimental group RSDI scores improved from 58.4 -/ 2.0 to 72.8 -/ 2.2 (P < or = .05) compared with those of the control group (from 59.6 -/ 3.0 to 60.4 -/ 1.1). Experimental group SIA scores improved from 3.9 -/ 0.1 to 2.4 -/ 0.1 (P < or = .05) compared with those of the control group (from 4.08 -/ 0.15 to 4.07 -/ 0.27). The number needed to treat to achieve 10% improvement on RSDI at 6 months was 2.0. Experimental subjects reported fewer 2-week periods with sinus-related symptoms (P < or = .05), used less nasal spray (P =.06). On the exit questionnaire 93% of experimental subjects reported overall improvement of sinus-related quality of life, and none reported worsening (P <.001); on average, experimental subjects reported 57 -/ 4.5% improvement. Side effects were minor and infrequent. Satisfaction was high. We found no statistically significant improvement on the SF-12.

**Conclusions:** Daily hypertonic saline nasal irrigation improves sinus-related quality of life, decreases symptoms, and decreases medication use in patients with frequent sinusitis. Primary care physicians can feel comfortable recommending this therapy.
A Controlled Trial of Long-Term Inhaled Hypertonic Saline in Patients with Cystic Fibrosis

Elkins M. R., Robinson M., Rose B. R., Harbour C., Moriarty C. P., Marks G. B., Belousova E. G., Xuan W., Bye P. T.P., the National Hypertonic Saline in Cystic Fibrosis (NHSCF) Study Group


Mucus Clearance and Lung Function in Cystic Fibrosis with Hypertonic Saline


Recent evidence suggests that nasal irrigation with hypertonic saline may be useful as an adjunctive treatment modality in the management of many sinonasal diseases. However, no previous studies have investigated the efficacy of this regimen in the prevention of seasonal allergic rhinitis-related symptoms in the pediatric patient. Twenty children with seasonal allergic rhinitis to Parietaria were enrolled in the study. Ten children were randomized to receive three-time daily nasal irrigation with hypertonic saline for the entire pollen season, which had lasted 6 weeks. Ten patients were allocated to receive no nasal irrigation and were used as controls. A mean daily rhinitis score based on the presence of nasal itching, rhinorrhea, nasal obstruction and sneezing was calculated for each week of the pollen season. Patients were allowed to use oral antihistamines when required and the mean number of drug assumption per week was also calculated. In patients allocated to nasal irrigation, the mean daily rhinitis score was reduced during 5 weeks of the study period. This reduction was statistically significantly different in the 3th, 4th and 5th week of therapy. Moreover, a decreased consumption of oral antihistamines was observed in these patients. This effect became evident after the second week of treatment and resulted in statistically significant differences during the 3th, 4th and 6th week. This study supports the use of nasal irrigation with hypertonic saline in the pediatric patient with seasonal allergic rhinitis during the pollen season. This treatment was tolerable, inexpensive and effective.