Salt Cave Therapy

Rediscovering the Benefits of an Old Preservative

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Countries in Eastern and Central Europe, where underground salt caves are located in mountainous regions, have a long tradition of "mining" these caves for their health benefits. This article examines traditional and contemporary complementary and alternative (CAM) applications of speleotherapy (salt cave therapy), halotherapy (therapy that replicates salt cave conditions), and forms of inhaled saline solution. Also reviewed is the accruing research evidence supporting the efficacy of exposure to high-salt environments for treating respiratory and other ailments.

Historical and Cultural Background

Speleotherapy (from *speleo*, Greek for cave), also considered a subterranean form of climatotherapy (therapies based on the healing capacities of natural resources), derives from observations since antiquity that miners who worked in salt mines did not suffer from respiratory problems characteristic of those working in other types of mines. Hippocrates is said to have recognized the therapeutic properties of salt mines.[1] Sodium chloride (NaCl), of course, plays a key role in the fluid electrolytes of living organisms. NaCl commonly occurs in the mineral form of halite or rock salt.[2]

Modern applications of speleotherapy have been traced to the writings in 1843 of a Polish physician working at the ancient Wieliczka salt mine near Krakow, Poland.* Salt mines used for therapeutic purposes, commonly associated with medical facilities and spas, are also located in other Eastern and Central European countries including Russia (Bereziki–Perm region), Austria (Sozbad–Salzeman region), Azerbaijan (Nakhichevan), Rumania (Sieged), Slovakia (Bratislava), and the Ukraine (Solotvino–Carpathians and Artiomovsk–Donietsk regions).[3]

In Russia (as in other European countries), shortages of medical supplies during wartime spurred reliance on natural traditional methods of healing and were frequently integrated with allopathic medicine after World War II.[4] Going to salt caves for health enhancement is as much a part of the Eastern and Central European spa medicine tradition as is "taking the waters" (balneotherapy) or sea air, and practitioners may combine several of these modalities. For example, the Ukrainian Allergologic Hospital, located in the foothills of the Carpathian Mountains, offers speleotherapy in nearby salt caves as well as treatments with water from these caves, and brine and mud from a nearby salt lake. Health benefits have been attributed to the caves' unique microclimate, which is rich in natural salt microns and ions, and which has a relatively constant temperature and humidity plus higher-than-surface pressure.[5]

In the 1980s, the Russians began to build halochambers lined with halite, which mimicked the microclimate of salt caves. With increased scientific attention, such chambers became certified as medical devices in Russia, and are said to have been adapted for use by the Russian space agency in microclimate optimization devices used by cosmonauts.[6]

Modern Applications

In areas where salt mines are still readily accessible and popular for therapeutic use by residents and tourists, halotherapy (from the Greek *halos* for salt) replicates the conditions of salt caves. Speleo-

*The Wieliczka salt mine is a United Nations Educational, Scientific and Cultural (UNESCO) World Heritage Site. Visit: www.krakow-info.com/wielicz.htm (accessed March 15, 2010) for more information.

therapy or halotherapy—the terms are often used synonymously—now involves sitting and inhaling salt microparticles diffused in an aboveground speleochamber, which is a specially designed room that replicates the unique conditions of a salt mine.

A typical salt room is built with tons of natural rock salt that contains 98% sodium chloride. Natural ionization of the air is supplemented with a dry sodium chloride aerosol, supplied by a nebulizer or salt pipe that typically delivers 5 mg of salt into the air during a 1-hour session.[7] This dry aeroso l, unlike liquid solutions, such as glutathione used in standard nebulizers, appears to reduce, rather than induce, bronchospasm.[1]

For patients with respiratory disorders, an initial course of 4 sessions is recommended to check for a beneficial treatment effect. A typical halotherapy plan then entails 14 1-hour sessions over 2 months with a 48-hour break between sessions. Additional treatments may be scheduled thereafter, once or twice a month depending upon the severity of the patient's condition. Additional sessions may be helpful at the time of year when a patient is more likely to experience symptoms, such as those caused by allergies.

While side-effects are minimal, some patients experience itchy skin, a tickling in the throat, or drainage of accumulated mucus, which can cause an increase in coughing during the time spent in the chamber. Because of these potential side-effects, it is recommended that treatment sessions be scheduled 2–3 days apart. (This initial possible worsening of symptoms prior to improvement has been termed "speleo-reaction.")[8]

Speleotherapy is not recommended for patients who have advanced hypertension or other serious heart conditions, or intoxication.[5] Contraindications noted by other sources include acute inflammatory diseases, fever, and contagious diseases.[9]

Israel has an eons-old history of therapeutic exposure to salt water (*thalassotherapy*) and salt air environments, particularly the Dead Sea, for health enhancement.[10] At the Hadassah Medical Center in Ein Kerem, Israel, Breathewell LLC™ (Jerusalem, Israel, and Cedarhurst, New York) established the country's largest salt-room therapy clinic and Research and Development Center in September 2009. The Center is part of a network of salt-room treatment centers, which include special rooms for children, built throughout the country in the past decade.

Patients—especially children—with asthma, bronchitis, lung disease, respiratory allergies, other respiratory-tract disorders, and chronic ear infections, have benefited from sitting in a room built of salt blocks and inhaling microscopic salt particles. These particles are said to act as a natural disinfectant, which kills harmful bacteria, accelerates mucous clearance, and improves lung function.[11] A success rate of 90% in treating pediatric asthma is claimed. This CAM therapy is recognized by the Israeli Ministry of Health.[5]

Baruch Bekker, R.N., a certified Ukrainian nurse specializing in respiratory problems, who serves as a speleotherapy consultant to Breathewell in Israel, remarked: "Speleotherapy is not just for sick people. My dream is to have people want to come to the Salt Room to prevent disease and strengthen the immune system. Today we are all exposed to air that is highly polluted and it is very important to keep the lungs healthy and clean."[12]

Halotherapy room for pediatric patients at Hadassah Medical Center Ein Kerem, Jerusalem, Israel. Photo courtesy of Breathewell LLC.™

Halotherapy is also gaining popularity in other countries. For example, halotherapy clinics are being opened in the United Kingdom, although their use as a complementary therapy for asthma or any other condition has not yet been approved by the United Kingdom's National Health Service (NHS).[13] Health Canada, a regulatory agency comparable to the U.S. Food and Drug Administration (FDA), has approved as a medical device a specialized nebulizer that releases monitored, finely pulverized dry sodium-chloride aerosol particles.[1] Yet, despite the long tradition of speleotherapy in Germany, halotherapy has not been approved for by public health insurance in that country, pending further clinical trials.[14]

In the United States, an increasing number of facilities offer such services for therapeutic and relaxation purposes. Some salt room facilities are operated under health care practitioner auspices. For instance, Dr. Margaret Smiechowski, a naturopathic physician originally from Poland, has designed salt chambers built in Rutland, Vermont (where she now resides), and other American cities.[15] However, other salt chambers are operated primarily to promote overall wellness and relaxation although their health benefits are often touted.

Some proponents of speleotherapy and halotherapy also point to a spiritual or metaphysical dimension of exposure to salt environments as being conducive to diminishing psychologic negativity and activating self-healing powers, via the resonant vibration of salt crystals.[16]

Portable Halotherapy Devices

For patients without ready access to actual or simulated salt-cave environments, a portable Salin Device air purifier,®† salt pipe inhalers, and salt lamps have been developed to produce

†A patent for the device was filed by Constantin Pascu in 2002 with the World International Property Organization, and a 2009 patent filing in the United States is pending.

salt-infused microclimates to expose patients to similar salt-infused conditions. The Salin Device, invented by a Rumanian chemical engineer, uses an internal fan forcing air through a filter with layers of microcrystalized salts (98% NaCl).

The mechanism of action is said to be sodium ions as the main cellular membrane stabilizer at the respiratory epithelium level. The air purifier/ionizer is approved as a medical device in Rumania,[17] as well as in Canada and Israel as noted above.

Use of this device is recommended mainly at night to allow a minimal daily exposure time of 8 hours, at a distance of 30–40 inches, with the device blowing the salinized air toward the individual. The device is marketed as providing air purification/ionization for a maximum of approximately 450 square feet. The small amount of salt in the filtered air (< 0.2 g/day) is not considered a concern for persons on salt-restricted diets for hypertension.

An increase in coughing upon initial use, as respiratory-tract secretions become more fluid, can be mitigated by reducing usage or setting the device's voltage lower if the coughing is problematic. Spaces with high humidity, dust, or oily aerosols can damage the filter.

Salt pipe inhalers are made of ceramic porcelain packed with salt crystals. Salt lamps, marketed as being made from salt crystals imported from Poland or the Himalayas, produce negative ions, which are believed to have healthful effects.[3] These portable devices may be used in combination with salt chambers. While no full-scale, randomized studies were located on the testing of these devices, their ability to deliver a specified dose has been pointed out as an advantage of halotherapy over traditional speleotherapy.[4]

Research Findings

Respiratory Disorders

In 2008, nearly 13 million Americans had asthma attacks, and, since 1999, the asthma attack prevalence rate has been highest among people ages 5–17.[18] The corticosteroids and other medications used as first-line mainstream treatments are well-known to produce many serious side-effects, particularly in children.

In a study of speleotherapy, 216 children with bronchial asthma were treated in salt mines near the town of Nakhichevan in the Republic of Azerbaijan. Assessment of clinical, immunologic, and functional parameters showed that the best and most stable results (i.e., those resulting in diminished broncho-obstructive syndrome) were achieved in cases of mild-to-moderate atopic asthma. The investigators recommended including speleotherapy as a complementary therapy to manage pediatric asthma.[19]

Halotherapy involves gradual inhalation of a dry sodium-chloride aerosol with particles from 2 μ to 5 μ in size. A study of 124 patients (15 of whom received placebo) with various types of respiratory diseases evaluated the effect of 10–20 daily 1-hour sessions on their conditions. Particle density varied with the type of condition.

After 3–5 sessions, three quarters of the patients had some improvement in expectoration of sputum as a consequence of more productive cough, auscultatory patterns of the lungs, and reduced frequency of coughing and respiratory discomfort. Halotherapy produced significant clinical improvement in flow-volume loop parameters and bronchial resistance. The Russian researchers attributed the outcomes to the dry sodium-chloride aerosol, the allergen-free, hypobacterial environment, and the comfortable room temperature and humidity.[3]

Another Eastern European study of 193 matched patients with respiratory diseases found that treatment with dry aerosol produced significant clinical improvement over placebo in 85% of mild and moderate cases, 75% in severe cases, and 97% in chronic bronchitis and bronchiectasis (destruction and widening of the larger airways). Common colds during cold season were reduced by half.[20]

A review in the Cochrane Database of Systematic Reviews in 2001,[21] and updated in 2006,[22] found three randomized clinical trials of speleotherapy with a total of 126 children with asthma, two of which reported that this therapy had a beneficial short-term effect on lung function. However, because only one study was deemed to be of reasonable methodological quality, the reviewers concluded that further randomized trials were required to permit a reliable conclusion to be drawn about whether this therapeutic intervention is effective for treating chronic asthma in this population.

A study assessed the effectiveness of salt-chamber treatment as an adjunct to low-to-moderate inhaled therapy for inpatients with asthma, who had bronchial hyperresponsiveness (BHR), to a histamine-inhalation challenge. After a 2-week baseline period, 17 of the 32 patients were randomized to receive active treatment, which consisted of 40-minute sessions 5 times a week of salt fed into a room by a salt generator; 15 patients were assigned to the placebo condition. Median provocative dosing causing a decrease of 15% in forced expiratory volume in 1 second (FEV_1) increased significantly in the active group but not the placebo group.[23]

Although nebulized saline has been used by clinicians to assist mucous clearance and to relieve breathlessness in patients with cystic fibrosis, chronic obstructive pulmonary disease (COPD), and bronchiectasis, many trials of nebulized therapy have used nebulized saline as a placebo. In a trial to establish if nebulized saline had a placebo or clinical effect, 40 patients who were hospitalized for exacerbation of COPD were randomized to a single-blinded administration of 4 mL of nebulized isotonic saline using either an efficient or inefficient nebulizer. Spirometry and subjective breathlessness scores were measured before treatment and 10 minutes after treatment.

According to a self-reporting scale, patients had a 23% improvement in mean breathlessness score following active nebulized saline, compared with a 4% improvement following placebo (the inefficient nebulizer). In addition, 65% of patients who received active treatment, but only 5% of the placebo group, reported that mucous expectoration was easier following treatment. Lung function was not affected. The researchers concluded that, because this study lends support to using nebulized

saline to relieve breathlessness by facilitating sputum clearance, "[n]ebulized saline can therefore be used as a placebo in bronchodilator studies involving COPD patients but it cannot be used as a placebo in trials assessing symptom relief."[24]

Respiratory Symptoms of Cystic Fibrosis

Patients with cystic fibrosis, a chronic inherited disease that affects the lungs and digestive system in about 30,000 children and adults in the United States, often require daily treatment to extract excess mucous buildup that clogs their lungs and can lead to life-threatening infections.[25] Preliminary studies have indicated that inhaled hypertonic saline (extra-salty sterile water mist) acutely increases mucociliary clearance and improves lung function and quality of life (QoL) in patients with cystic fibrosis in short-term trials.

For example, Rumanian researchers reported at the 24th European Cystic Fibrosis Conference held in Vienna, Austria, in 2001, that of 18 patients with mild-to-severe cystic fibrosis, ages 3–17, 8 exposed to an active ionization device (Salin device) were rated as improved by their parents; patients also showed objective improvement in FEV_1 as well as reduced colonization with particular pathogens and reduced incidence of other respiratory complications. None of the patients withdrew from the study because of adverse effects.[26]

Such findings were confirmed in a long-term, double-blinded, parallel-group trial of 164 patients who were at least 6 years old. The patients had stable cystic fibrosis with mild-to-moderate lung disease. The patients were randomly assigned to inhale 4 mL of either a 7% hypertonic saline solution or an 0.9% saline solution (control) twice daily for 48 weeks, with quinine sulfate (0.25 mg per mL) added to each solution to mask the taste. A bronchodilator drug was administered before each dose to open each patient's airways, and other standard therapies were continued during the trial.

Compared with the control group, the hypertonic-saline group had improved lung function as measured by significantly higher forced vital capacity (FVC) and FEV_1, and fewer pulmonary exacerbations. Forced expiratory flow (FEF) at 25%–75% of FVC ($FEF_{25–75}$) was similar in the two groups. Hypertonic saline was also associated with reductions in the frequency of exacerbations and antibiotic use for exacerbations, but not with worsening bacterial infection or inflammation. Acute side-effects noted by some participants included increased coughing, sore throat, and chest tightness. Reporting in *The New England Journal of Medicine*, the researchers concluded: "Hypertonic saline preceded by a bronchodilator is an inexpensive, safe, and effective additional therapy for patients with cystic fibrosis."[27]

The Cystic Fibrosis Foundation, which funded this study, advises families that patients should be assessed by their care teams to determine whether hypertonic saline is a safe adjunctive therapy for such patients. To avoid contamination and improper dosing, the Foundation also advises patients to only use a saline solution prepared by a pharmacy according to a doctor's prescription, to clean and disinfect the nebulizer used to administer the saline solution, and to continue usual care.[28]

Resource

International Society of Medical Hydrology and Climatology (ISMH)
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Major objectives of the ISMH are to design, coordinate, and disseminate international research, and establish guiding principles and standards, in the fields of spa therapy and health-resort medicine (which includes salt cave therapy).

An updated systematic review, likewise, found studies showing improvement in the short-term (after 4 weeks) in FEV_1, QoL, and reductions in pulmonary exacerbations with no increase in infection rates. However, these improvements were not sustained in the single long-term trial reviewed at 48 weeks.[29]

Dermatologic Disorders

Russian researchers recommended speleotherapy for the treatment of atopic dermatitis based on the outcome of a study with 112 children with the chronic skin disorder who were exposed to a chamber with an artificial microclimate created with the use of natrium chloride spraying. At 24 months, a complete positive dermatologic and immune response was reported in 58% of patients, a partial response was reported in 20%, and no response was reported in 6.9%.[30]

Exposure to salt environments for treating skin conditions such as psoriasis at locations including the Dead Sea in Israel has been in practice with demonstrated improvements since ancient times.[31] However, scientific studies specifically focusing on utilizing natural or simulated salt caves for such conditions were not located.

Otitis Media

Most children up to ages 3 or 4 have at least one acute episode of nonsuppurative ear inflammation from otitis media. Therapy with the Salin device offers a CAM approach to treating this condition, which may lead to impaired hearing if the problem becomes chronic.

In a clinical trial of the device they developed, Zabos Dorinela, MD, an ear, nose, and throat specialist at the #3 Clinic Emergency Hospital for Children in Timisoara City, Rumania, and Constantin Pascu, a chemical engineer, assessed the clinical status of pediatric patients using the device as an adjunct treatment compared to controls receiving standard care only (N = 63; average age: 6.9 years; 29 boys, 34 girls). The patients were monitored monthly for overall clinical status and tested with otomicroscopy and audioimpedancemetry monthly and during flareups of symptoms. Allergy tests were administered to some patients to assess comorbid ototic and respiratory disorders. After 1 year, acute recurrences of otitis were half as frequent among

the patients treated with the Salin device, compared with what occurred in the placebo group (one compared to two flareups).[32]

Other Disorders and General Health Enhancement

Although speleotherapy and halotherapy have also been cited for benefits in patients with rheumatologic, heart, vascular, digestive, and nervous system conditions, as well as immune-system and general-health enhancement, the evidence to date has been clinical and anecdotal rather than research-based.

Conclusion

Speleotherapy has a long history of being rooted in the holistic medicine of Eastern and Central European countries. There is growing interest in this traditional therapy and its simulations in halotherapy in the West for treating a number of conditions. Thus, further research is warranted to validate the safety and efficacy of this nonpharmacologic adjunct to corticosteroids, long-acting β-agonists, and other prescription drugs with a high-risk profile for treating asthma, cystic fibrosis, and other conditions.

Controlled salt environments, in particular, offer a promising potential for evidence-based research. Western utilization of this modality could also be advanced further if relevant research articles in Russian and other Eastern and Central European languages were made more widely available in English-language sources.

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