

The effect of carbonated mineral water and mofette treatment in Baile Tusnad after ischemic stroke – a case report

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Abstract

Carbon dioxide baths might represent an effective therapeutic method in the rehabilitation of coronary heart disease, myocardial infarction and stroke, as well as in the treatment of chronic venous insufficiency, inflammatory diseases and functional disorders. According to the World Health Organization, 5.5 million deaths from stroke were recorded in 2001, and about 15 million people survive stroke every year. Mortality from stroke is 11% for women and 8.4% for men. According to the European Association for Cardiovascular Prevention □ Rehabilitation, phase II and III cardiovascular rehabilitation is performed in Romania only in a proportion of 10%. The therapeutic effects of carbonated mineral waters are due to the action of carbon dioxide. This induces cutaneous vasodilation, with a decrease in blood pressure values. It also causes an increase of cardiac output, while reducing blood pressure and heart rate. Mofettes are natural emanations along the Harghita volcanic massif, which contain CO₂ in concentrations of 90-98% with cutaneous vasodilator effects, increasing cerebral and muscle blood flow. The natural therapeutic factors in Baile Tusnad, consisting of carbonated mineral water baths, mofettes, climate therapy, along with medical physical culture, indicated in the rehabilitation treatment of post-stroke patients had a beneficial effect on clinical and functional symptomatology, improving the quality of gait and balance, functionality and exercise capacity in a patient who suffered stroke five years before and was followed up for three years, while she attended an annual medical rehabilitation program in Baile Tusnad. Continuing medical rehabilitation programs, in the absence of contraindications, in Romanian spa resorts for cardiovascular treatment, as well as conducting randomized clinical studies on the efficiency of these treatments is important.

Key words: *rehabilitation, stroke, carbonated mineral water, mofette*

Introduction

Balneotherapy with carbonated mineral waters has been used since the Middle Ages, but its use in patients with cardiovascular disease is not considered to be fully scientifically grounded [1]. The same study evidenced three main effects of total or partial immersion: a decrease in central temperature, an increase in cutaneous blood flow, and an increase in the thermal sensation score [1].

Carbon dioxide baths might represent an effective therapeutic method in the rehabilitation of coronary heart disease, myocardial infarction and stroke, as well as in the treatment of chronic venous insufficiency, inflammatory diseases and functional disorders [2,3]. Carbonated mineral water baths are considered to be effective in the treatment of peripheral vascular disorders [4].

The relationship between oxidative stress and the progression of vascular disease is the focus of attention due to the possibility of measuring free radicals. Oxidative stress induces an inflammatory response that is directly involved in the pathogenesis of atherosclerosis, being currently considered the most important initiator and promoter of endothelial

cell injury. Carbon dioxide absorption by the body is 100 times higher than water absorption [5]. A recent study was conducted to investigate the specific therapeutic effects of successive carbon dioxide baths on the release of plasma free radicals, being the first study on oxidative status markers and balneotherapy with carbonated mineral water. The aim of this study was to evaluate the release of free oxygen radicals in patients with chronic occlusive arterial disease treated with carbonated mineral water. Based on the data of the Italian study, there are reasons to believe that an increase in free radical scavenging activity is also beneficial in occlusive arterial disease and that this activity can reduce systemic and local inflammatory response after ischemia-reperfusion injury [7,8]. The neutralizing agent could be represented by carbonated mineral water baths [9]. This study demonstrated a reduction of oxidative stress after 2 weeks of balneotherapy with carbonated mineral water in patients with chronic occlusive arterial disease [7,8].

According to clinical studies performed in Baile Tusnad, carbonated mineral water therapy, kinesiotherapy, climate therapy – arotherapy for 16

days resulted in an improvement of the walking speed, of the quality of gait. Statistically significant results $p < 0.05$ were also obtained for balance. On the movement assessment scale, when evaluating patient performance in ten activities of daily living depending on required external assistance, using the Barthel Index and the Quality of Life Scale, statistically significant results were obtained. There were no side reactions to the treatment applied [10,11]. In the case study of a patient with chronic occlusive arterial disease, the use of carbonated mineral waters in Baile Tusnad led to an improvement of pain, an increase in the walking distance and speed [12]. An important role in the case of cardiovascular patients, the majority of which are also diagnosed with diabetes mellitus, is played, in addition to the use of natural therapeutic factors, by therapeutic exercises [13].

The administration of carbonated mineral water from spring number 3 in Baile Tusnad had a regenerative potential in an experimental study in which alcoholic fatty liver was induced [14,15].

In studies conducted in Covasna, by applying medical rehabilitation programs consisting of mofette, carbonated mineral water and climate therapy, long-term beneficial effects were observed, but in order to obtain an improvement of cardiovascular risk factors, long-duration cardiovascular rehabilitation programs are required, along with lifestyle changing, prevention measures [16,17]. Based on clinical observations, the effects of CO₂ baths on human subjects are bradycardia, slight changes in blood pressure, an increase in the temperature of the exposed skin [18].

According to the World Health Organization, 5.5 million deaths from stroke were recorded in 2001, and about 15 million people survive stroke every year. Mortality from stroke is 11% for women and 8.4% for men. Prospective studies show that this disorder increases year after year both in terms of incidence and prevalence; WHO experts estimate that stroke will become the main cause of mortality by 2030. The death rate after a first stroke is 12% within 7 days, 19% within 30 days, and 31% within a year. About 80% of stroke survivors become disabled. The 2016 objective of rehabilitation after stroke was for more than 70% of stroke survivors to gain independence in activities of daily living 3 months after stroke [25].

CASE REPORT

We present the case of a 60-year-old female patient, hypertensive for 10 years, on antihypertensive therapy and sodium-free diet, with a sedentary lifestyle. Two years before, she was ultrasonographically diagnosed with hepatic steatosis, suffering from frequent abdominal bloating. Five years before, she had an ischemic stroke, according to magnetic resonance imaging. During the first two years from the cerebrovascular accident, she was admitted to the Clinical Rehabilitation Hospital Cluj-Napoca. For three years, she has attended medical rehabilitation treatment once a year, in Baile Tusnad. The patient has left hemibody motor deficit, she walks with a stick over distances longer than 100 m, while she can walk by herself over short distances, and she has mild balance disorders. Every year, the medical rehabilitation program consisted of carbonated mineral water baths, at 32 degrees Celsius, for 15 minutes, mofette therapy starting with 5, then 15, 20 minutes, massotherapy for 10 minutes, special kinesiotherapy with exercise training and rehabilitation of walking, coordination, balance for 30 minutes, aerotherapy and climate therapy for 30 minutes, internal crenotherapy with mineral water from spring no. 3, beneficial for chronic hepatic diseases [14,15], in therapeutic doses. Mofettes are natural emanations along the Harghita volcanic massif, which contain CO₂ in concentrations of 90-98% and small amounts of H₂S, N₂ and Rn, with cutaneous vasodilator effects, increasing cerebral and muscle blood flow [19,20,21]. Treatment was performed for 14 days every year. Every year, the patient was clinically assessed at the beginning and at the end of treatment using the Tinetti balance scale, the 10-m walking test, adverse reactions, changes in blood pressure, ventricular rate and electrocardiogram. Over the three years, she had no other admissions to medical rehabilitation services. During the course of treatment, no adverse reactions occurred; blood pressure slightly increased in the first days of treatment, but returned to normal over time. There were no changes in electrocardiogram. All admissions showed a progressive improvement in balance disorders based on the Tinetti scale, as well as an increase in joint mobility measured by goniometry. However, the best results, reported by the patient herself, were observed for walking, through an increase in the walking distance and

speed, the improvement becoming more obvious with each year. Also, after crenotherapy with water from spring no. 3, transaminase values measured annually were within normal limits, the patient reporting a diminution of abdominal bloating.

On the Tinetti balance scale, at the first admission to Baile Tusnad, a score of 16 points was obtained before treatment and 18 points after treatment. At the second admission, the score increased from 18 points to 19 points and at the third admission, the evaluation score ranged between 20 and 22 points. On the 10-m walk test, at the first two admissions, the recorded time was 35 and 30 seconds, respectively, and at the third admission, 25 seconds.

DISCUSSIONS

Cardiovascular mortality ranks first in Europe, both among men and women [22]. This is why particular emphasis is currently placed on the early diagnosis and correct treatment of this category of patients. At the same time, the importance of long-term patient follow-up by applying secondary prevention measures and cardiovascular rehabilitation programs is emphasized [16,17].

According to the European Association for Cardiovascular Prevention & Rehabilitation, phase II and III cardiovascular rehabilitation is performed in Romania only in a proportion of 10% [23].

The therapeutic effects of carbonated mineral waters are due to the action of carbon dioxide. This induces cutaneous vasodilation, with a decrease in blood pressure values. It also causes an increase in cardiac output, while reducing blood pressure and heart rate [19,20,21]. Physical training, medical physical culture plays a crucial role in the rehabilitation of cardiovascular patients. This has many beneficial preventive effects, increasing exercise capacity, reducing cardiovascular risk in both healthy subjects and cardiovascular patients, and it also favorably influences risk factors, both indirectly, by increasing treatment compliance, and directly. Physical training, in addition to enhancing exercise capacity, significantly reduces global cardiovascular risk [24].

RESULTS

The natural therapeutic factors in Baile Tusnad, consisting of carbonated mineral water baths, mofettes, climate therapy, along with medical physical culture, indicated in the rehabilitation treatment of post-stroke patients had a beneficial effect on clinical and functional symptomatology, improving the quality of gait and balance, and exercise capacity. Continuing medical rehabilitation programs, in the absence of contraindications, in Romanian spa resorts for cardiovascular treatment, as well as conducting randomized clinical studies on the efficiency of these treatments is important.

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