

Department of Orthopedics, Faculty of Medicine,
University of Szeged, Clinical Medicine Doctoral School

SULPHUR BATH IN THE TREATMENT OF MUSCULOSCELETAL DISORDERS

Summary of Ph.D. Thesis

CSABA KOVÁCS M.D.

Supervisor:

Tamás Bender, M.D., Ph.D., D.Sc.

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INTRODUCTION

It has been proved that balneotherapy, which means in today's terms the use of mineral water, mud and various gases for therapeutic purposes, has been around since the Antiquity in the form of bathing and drinking cures.

In sulfurous waters, the sulfur can be found in a variety of forms. The dominant component is hydrogen sulphide (H_2S), but in addition, sulfur also occurs in water in the form of hydrogen sulfide ions (HS^-), thiosulfate ions ($\text{S}_2\text{O}_3^{2-}$) and sulfide ions (S^{2-}). Sulfurous mineral water is easy to recognise due to the conspicuous smell reminiscent of rotten eggs.

During bathing, sulfur enters the body via the skin and the respiratory tract.

Once in the skin, sulfur has an antibacterial and keratolytic effect, and it blocks the Langerhans cells.

It is assumed that after dermal absorption the sulfide also gets into the connective tissues and the joints, but no studies supported with accurate measurements are available yet concerning their direct incorporation.

On the basis of existing studies, it appears that sulfur baths effect the body in various ways, and have immune modulating, anti-inflammatory and anti-oxidant effects as well. In the clinical practice, their functions of relieving pain and improving joint functions have also been observed, which is why they have been used to this day for the treatment of musculoskeletal disorders. Unfortunately, there are few evidence-based clinical studies available, and a limitation of most studies is the low number of patients involved.

A major step forward is that 2014 OARSI Guideline mentions balneotherapy for the first time on the same level in the treatment of knee joint arthrosis with biomechanical interventions, intra-articular steroids, oral COX-2 inhibitors and antidepressants in the treatment of generalised arthrosis involving comorbidities. However, very limited data is available on the efficacy of balneotherapy in the treatment of arthrosis of the small joints of the hand and hip joint arthrosis, and therefore, we conducted our studies with respect to these locomotor diseases. Sulfurous water still has many hidden secrets, which is why it is worth continuing to study its chemical effects.

AIMS OF THE THESIS

I.

The aim of our study was to determine the effects of bathing in sulfurous water on pain, the morning stiffness of the joints and on manual functions among patients suffering from arthrosis in the joints of their hands. As a secondary objective, we also aimed to survey changes in the quality of the patients' lives. When designing our investigation, we have not found a similar clinical study in the medical literature.

II.

Limited data is available on the effects of balneotherapy in the arthrosis of the hip joint, which is the reason why we initiated our study of this question. The primary purpose of the clinical investigation was to determine if balneotherapy (immersion in sulfurous mineral water) applied in addition to corrective gymnastic therapy performed at home among patients with arthrosis of the hip has a more expressed, or perhaps more permanent effect than the corrective gymnastic therapy alone. The primary considerations were joint pain, stiffness and function. An additional objective was the assessment of the change in quality of life.

THE EFFECT OF SULPHUROUS WATER IN PATIENTS WITH OSTEOARTHRITIS OF HAND. DOUBLE-BLIND, RANDOMIZED, CONTROLLED, FOLLOW-UP STUDY.

Method

The treatments took place in the Zsóry Thermal Bath of Mezőkövesd. The mineral water of Mezőkövesd can be placed in the category of sulfurous waters: it is one of waters in Hungary with the highest concentration of sulfide ions (13.2 mg/l). One of the groups (the balneotherapy group) bathed in sulfurous water, while the other group (the control group) in tap water. In both cases the treatment took place in single tubs. The patients received 15 treatments, lasting 20 minutes each, over the course of 3 weeks. The temperature of both the medicinal and the tap water was 37°C. The tubs could be filled with either medicinal or tap water, which means that the treatment could take place in any of the tubs. The sulfurous smell that could be felt all over the premises was confusing for the control group in terms of what type of water they were bathing in. Examinations took place in both groups on four occasions: at the beginning and at the end of the cure, as well as after 3 and 6 months. The parameters examined were the following: hand pain measured on a visual analogue scale (VAS 0-100 mm), morning stiffness of the joints (RIM) as estimated by the patient (minutes), the clamping force of the hands as measured with a Dyna-9 device (Newton), Health Assessment Questionnaire (HAQ) and AUSCAN index, as well as EuroQol (EQ5D+EQVAS) questionnaire on quality of life.

The statistical calculations were made using SPSS 15.0 software. The distribution was examined with the use of a Kolmogorov-Smirnov test; the data of the two groups were compared with a Mann-Whitney test. Taking into account the Bonferroni correction, the statistical significance limit was $p < 0.008$.

Results

The 47 patients were randomised, 24 were placed in the group receiving balneotherapy and 23 in the control group.

At the end of the treatment, those in the balneotherapy group showed significant improvement in terms of each of the parameters examined. 3 months later, the significant improvement remained with the exception of the morning stiffness of the joints and EQ5D.

6 months after the treatment, all parameters continued to show significant improvement with the exception of the morning stiffness of the joints, the clamping force of the hand, and Euro-Qol.

With respect to the control group, there was significant improvement at the end of the cure in all parameters with the exception of pain, HAQ and EuroQol, but the extent of the improvement was smaller than in case of the balneotherapy group.

After 3 and 6 months, we did not find improvement in terms of any of the parameters examined in the group bathing in tap water.

Comparing the results of the two groups, we found significant differences, with the group receiving balneotherapy having better results, in terms of the pain ($p=0.002$) at the end of the treatment, also in terms of the pain ($p=0.006$) and in terms of quality of life (EQVAS $p<0001$) 3 months later. 6 months after the treatment, we could not find significant differences between the two groups in terms of any one of the parameters examined.

EFFECT OF SULPHUR BATH ON HIP OSTEOARTHRITIS. A RANDOMIZED, CONTROLLED, SINGLE-BLIND, FOLLOW-UP TRIAL. A PILOT STUDY.

Method

The study was conducted in two groups. Patients in both groups performed corrective gymnastic therapy at home for 3 weeks, on the basis of the written and pictorial guide issued to them. In addition, to the exercises, the first group (the balneotherapy group) also received 15 treatments of balneotherapy involving immersion in sulfurous mineral water for 20 minutes per occasion. The second group (the control group) only performed the exercises at home. Both groups performed the same, active exercises. Each of the patients were examined three times: before the first treatment, at the end of the 3-week cure, and after the treatments.

As a primary objective, the WOMAC Likert 3.1 index assessing pain, joint stiffness and changes in the functions, and as a secondary objective, the EQ-5D quality of life questionnaire was completed. Both questionnaires were completed at the time of each of the three patient visits.

The statistical calculations were carried out with the use of SPSS 22 software, by an independent person.

The normality was examined by way of a Kolmogorov-Smirnov test, and the data were compared with the use of a repeated measures ANOVA test.

During the statistical analysis, the value of $p < 0.05$ was considered as significant.

Results

In the course of the investigation 44 patients were randomised, with 22 patients in each of the balneotherapy group (average age: 59.14 ± 7.55 years) and the control group (average age: 60.66 ± 7.6 years).

Comparing the results of the two groups, we found significant differences, with the group receiving balneotherapy having better results, only in terms of the WOMAC stiffness score ($p = 0.041$) at the end of the treatment, however, 12 weeks later, in terms of WOMAC pain ($p = 0.041$), stiffness ($p = 0.001$), and function ($p = 0.03$) scores, as well as the total score ($p = 0.018$). After 12 weeks, we found significant improvement in quality of life (EQVAS $p = 0.026$).

ETHICAL ASPECTS

The studies were approved by the Regional Research Ethics Committee. Participants in the clinical trials had received written information before they signed the informed consent forms.

CONCLUSIONS, DISCUSSION, NEW RESULTS

I. On the basis of the double-blind, controlled, randomised study with follow-up conducted among patients suffering from the arthrosis of small joints of the hand, it appears that balneotherapy with immersion in sulfurous mineral water is an effective therapy in the treatment of the arthrosis of the small joints of the hand. The positive impact was primarily observed in terms of improvements for 3 months concerning pain and quality of life experienced by the patients.

We explain the relative improvement of the patients bathing in mineral water in comparison with the control group primarily with the chemical effect of the mineral water, i.e. its sulfur content, since the physical and thermal effects were the same in the two groups.

The limitation of the study was the low number of patients involved in it.

II. The results of our investigation suggest that balneotherapy with immersion in sulfurous water applied in addition to corrective gymnastic therapy performed at home reduces pain and improves the joint functions.

According to some studies, as well as the review of the Cochrane database for 2014, it appears to be proven that gymnastic exercises reduce pain in the joints and improve the motoric functions in case of the arthrosis of the hip joint. We have no similar data for balneotherapy in case of patients suffering from this illness.

By the end of the treatments, significant improvements were found in the results of both groups, and in terms of stiffness, we found significantly better results in case of those who received the balneotherapy treatment.

It appears that the application of the two types of treatment together has a longer-lasting effect than the corrective gymnastic therapy alone, since after 12 weeks, those who received balneotherapy treatment had significantly better results in terms of pain in the joints, stiffness and functions, as well as in their quality of life. In summary, it can be concluded that corrective gymnastic therapy has a positive effect on pain and hip joint functions also when applied in itself for the treatment of the arthrosis of the hip joint, but more effective and more permanent results can be achieved if this treatment is combined with balneotherapy with immersion in sulfurous water.

The limitation of our investigation was the low number of patients, as well as the use of the single blind method, namely that the patients were aware of what kind of treatment they received.

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