

ORIGINAL ARTICLE

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Balneotherapy in Treatment of Spastic Upper Limb after Stroke

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ABSTRACT

Introduction: After stroke, spasticity is often the main problem that prevents functional recovery. Pain occurs in up to 70% of patients during the first year post-stroke. **Materials and methods:** A total of 70 patients (30 female and 45 male) mean age (65.67) participated in prospective, controlled study. Inclusion criteria: ischaemic stroke, developed spasticity of upper limb, post-stroke interval <6 months. Exclusion criteria: contraindications for balneotherapy and inability to follow commands. Experimental group (Ex) (n=35) was treated with sulphurous baths (31°-33°C) and controlled group (Co) with taped water baths, during 21 days. All patients were additionally treated with kinesitherapy and cryotherapy. The outcome was evaluated using Modified Ashworth scale for spasticity and VAS scale for pain. The significance value was sat at $p<0.05$. **Goal:** To find out the effects of balneotherapy with sulphurous bath on spasticity and pain in affected upper limb. **Results:** Reduction in tone of affected upper limb muscles was significant in Ex group ($p<0.05$). Pain decreased significantly in Ex-group ($p<0.01$). **Conclusion:** Our results show that balneotherapy with sulphurous water reduces spasticity and pain significantly and can help in treatment of post-stroke patients.

Key words: stroke, spasticity, balneotherapy.

1. INTRODUCTION

Spasticity is one of the most commonly encountered problems in neurological rehabilitation. It can cause pain (1), discomfort and lead to joint contractures and prevent functional mobility. According to different authors, spasticity occurs in up to 38% of patients after stroke (2). Early intensive therapy has been shown to speed up functional recovery following a stroke (3). However, limited therapy resources in many hospitals inhibit intensive therapy in daily practice (4). In our country, stroke survivors enter a rehabilitation program at variable intervals after the acute event, and use of Botulinum neurotoxin is still very limited. Benefits from even the short-term relief of spasticity in stiff muscles should not be underestimated. Results of numerous studies showed positive effects of sulfurous mineral water in different conditions (5,6). Hypothesis was: if sulfurous mineral water has positive effects on decreasing pain and increased muscle tone in studied conditions, it should be efficient in the patients after stroke as well.

2. GOAL

The goal of study was to determine effects of sulfurous baths on spasticity, pain, range of motion (ROM) in affected upper limb and motor control of affected arm after stroke.

3. MATERIALS AND METHODS

This prospective, randomized, observer-blind (controlled) study was carried out at PRM and Balneology Institute „Mlječanica“, according to the Good Clinical

Practice. The study protocol was approved by Institutes's Ethics Committee and written informed consent was obtained from participants and/or care givers. Participants were patients with first rehabilitation after ischaemic stroke admitted to the Institute from February 2009 till November 2011. Intervals from the acute event were from 6 weeks to 6 months. Inclusion criteria: developed spasticity of affected upper limb. Exclusion criteria were hemorrhage stroke, fixed contracture, reduced range of motion (ROM) before the stroke, contraindications for balneotherapy (for experimental group), inability to follow simple commands, age bellow 40 and over 75. Total of 70 patients (mean age 65.67) who met the inclusion criteria were randomly assigned to the experimental (EX-group) and control (CO-group) group, 35 in each. Examiner involved in outcome efficacy assessments was blinded to the treatment assignment. Treatment protocol lasted 21 days and included kinesitherapy and cryotherapy (ice massage) of spastic muscles 5 minutes before kinesitherapy. Experimental group had sulfurous baths for 20 minutes, every day except Sundays, 3 hours after breakfast; temperature of water was 31-33 degree Celsius. Control group had baths in plain water (hydrotherapy) under the same conditions. Natural water used in this study is very rich in minerals (Table 1).

Assessments were done at baseline (before the first treatment) and after 21 days (24 hours after the last bath). Efficacy was assessed by changes in the tone of all muscle groups of affected upper limb, using the six-point Modified Ashworth Scale (0= no increase in tone, 4= rigid

COMPOUND	mg/l	m.mol/l	m/val/l	m.val%	
ANIONS	Hydrocarbon	577.06	9.460	9.460	18
	Chloride	15.80	0.440	0.440	1
	Sulfate	2840.00	21.250	42.500	81
	Phosphate	0.01	0.000	0.000	-
	Total mineralization (mg/l)	2932.87			
KATIONS	Sodium	165.00	7.174	7.174	14
	Potassium	7.20	0.185	0.185	-
	Calcium	436.86	10.900	21.800	41
	Magnesium	257.79	10.600	21.200	40
	Strontium	11.20	0.127	0.225	1
	Ammonium	35.00	1.940	1.940	4
	Total mineralization (mg/l)	913,06			

Table 1. Physical chemical analysis of sulfurous mineral water „Mlječanica”

Group	Experimental	Control
No. of subjects	35	35
Age	64.60	66.74
Sex	M=21; F=14	M=24; F=11
Affected side	L= 21; R= 14	L= 21; R= 14
Period between stroke and treatment (in days)	69.82	82.22

Table 2. Demographic characteristics of the subjects

in flexion or extension) (7). For pain evaluation we used VAS (8). The testing area was quiet and screened from other therapists and patients. The participants were assessed by two raters, author and senior physiotherapist, each of them performed two measures, both blinded to the treatment assignment. As main statistical technique in our study, we used Student t-test for independent samples. If variable had small quantitative values, we used χ^2 test (Chi-square) as a retest. Relations between variables were proved using Pearson correlation coefficient. Sample size was determined a priori using t-test power method (according to Cohen), and we got valid sample size of 70 subjects with two groups of 35 subjects each.

4. RESULTS

Total of 70 patients (45 male and 25 female, mean ages 66.74) participated in the study, 35 in each group. Both groups were homogeneous regarding the age, gender, affected side and post-stroke interval (Table 2).

The tone of wrist and elbow flexors and forearm pronators decreased significantly in the experimental group treated with sulfurous water baths ($p < 0.05$) (Figure 1).

Pain decreased significantly in Ex-group ($p < 0.01$) (Figure 2).

5. DISCUSSION

Analysis of demographic characteristics of patients shows homogeneity between groups. The most of the participants were in age group over 70, total of 31 subjects, which is in accordance with new epidemiological studies which point out so called “aging population” and increased portion of population older than 65 [9]. There were more men in both groups. These data correspond to world data of increased incidence of stroke in male

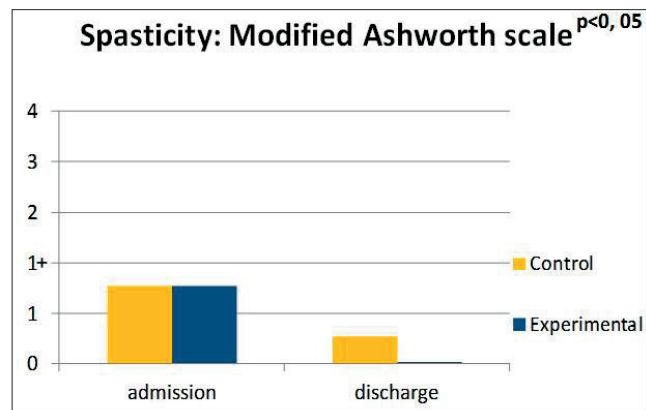


Figure 1. Decrease of spasticity in groups, measured by modified Ashworth scale

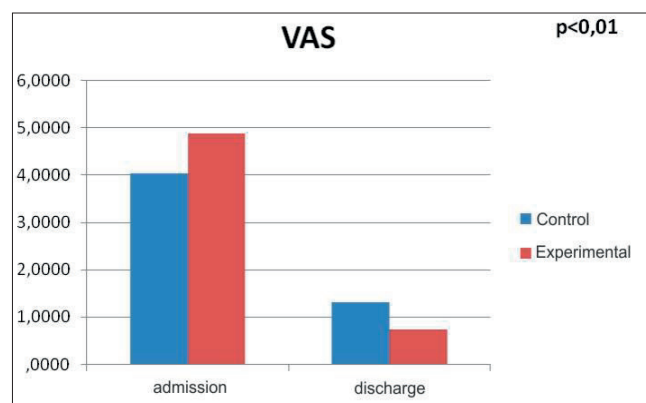


Figure 2. Decrease of subjective feeling of pain, measured by visual-analog pain scale

population, and also these data correspond to data about hospitalized patients with strokes in Republic of Srpska in last 5 years (10). Homogeneity is present in both groups regarding affected side. In both groups there are 60% of left-sided hemiplegia. Similar surveys show that left-sided hemiplegia occur more often than right-sided (11). Average interval between the stroke and beginning of rehabilitation was 69.82 for experimental and 82.22 days for control group, which both are long periods. Reasons could be in deficit of specialized institutions which treat these patients, as well as small capacities of existing institutions. The results of present study showed that sulfurous mineral water baths decrease the muscle tone in the affected upper limb after stroke. Decrease in tone of all muscle groups of affected upper limb in Ex-group treated with sulfurous baths has reached statistical significance and it is obviously comparing to Co-group treated with tap water baths ($p < 0.05$). After the acute stroke, mechanisms for alpha-motor neuron inhibition by pyramidal system are disturbed, which causes increase in muscle tone. Considering that stimulus from muscle spindle has excitatory effect on alpha motor neurons, factors reducing transport of the stimulus through afferent thread should also reduce activation of alpha motor neuron (12). Mineral water acts by increasing pre-synaptic inhibition of alpha motor neurons responsible for muscle tone.

6. CONCLUSIONS

Sulfurous mineral baths showed positive effects on reduction of spasticity ($p < 0.05$), decrease of pain $p < 0.01$) of patients after stroke. Treatment with sulfurous mineral

baths is justified and contributes to faster recovery in patients after stroke. It is cost effective in countries rich in natural mineral waters.

CONFLICT OF INTEREST: NONE DECLARED.

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