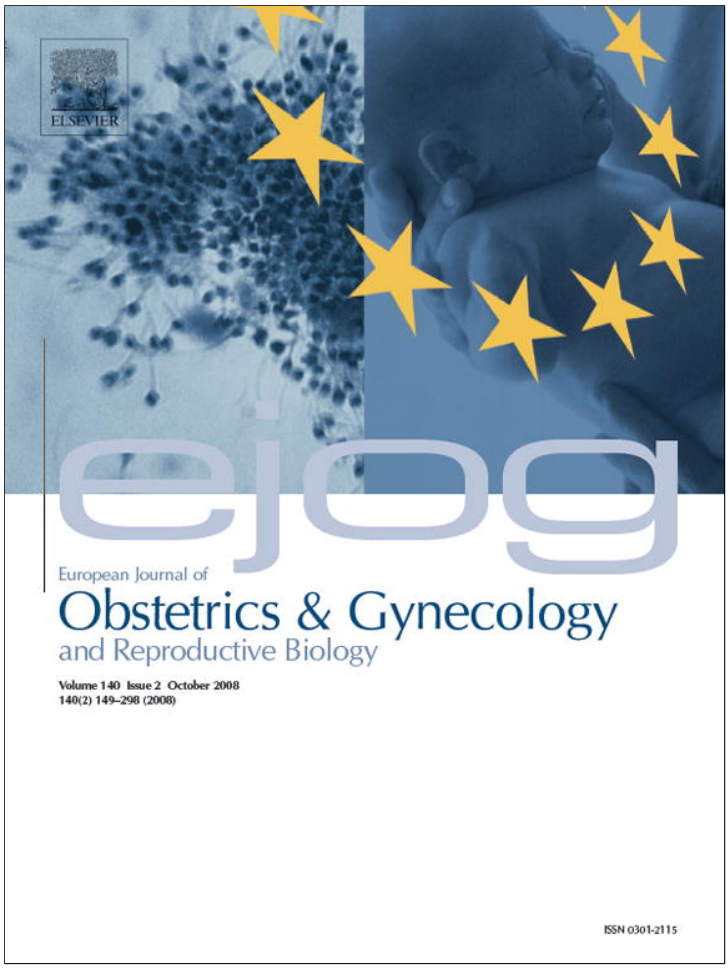

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The efficacy of alum-containing ferrous thermal water in the management of chronic inflammatory gynaecological disorders—A randomized controlled study

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Abstract

Objectives: Treatment of gynaecological disorders is a frequent, but only barely substantiated application of balneotherapy. This study investigated potential differences between the clinical symptoms, pelvic blood flow and specific laboratory parameters of patients undergoing balneotherapy with two different types of immersion: alum-containing and tap water.
Study design: The study population comprised 40 patients (mean age: 39.4 years), randomized into two groups. All subjects took 20 min baths in 38 °C water every other day, for 10 occasions altogether. Study parameters were: pain relief, reduction in tissue growth, hormone levels, psychic status, and pelvic blood flow.
Results: Thermal water improved the clinical parameters of both groups significantly. In comparison with tap water, treatment with alum-containing water accomplished significantly greater progress, as reflected by the relief of pain elicited by handling the uterus and improvement of psychic status. Laboratory parameters (FSH, LH, prolactin, oestradiol and beta-endorphin serum levels) and the Doppler index did not change in either group.
Conclusions: As demonstrated by our results, 3-week balneotherapy is a potentially useful adjunct for the management of chronic pelvic inflammatory disease, but further, long-term studies are notwithstanding necessary.

Keywords: Alum-containing water; Balneotherapy; Chronic pelvic inflammatory disease

1. Introduction

Balneotherapy uses mineral water of appropriate temperature (i.e. thermal water) both internally (i.e. water-drinking treatment) and externally (as baths), along with mud therapy and medicinal gases. Hydrotherapy, by contrast, is treatment in tap water, the therapeutic actions of which are determined by its physical properties (buoyancy, fluid pressure, and temperature), primarily. The term 'spa therapy', as interpreted in Anglo-Saxon countries, often means complex treatment – involving balneo-, hydro- and electrotherapy, remedial gymnastics and massage, as well as their combinations – in a special environment. The latter is important, because the psychic influence of getting away from the familiar, everyday surroundings to undergo therapy adds advantage to treatment.

Water has been used medicinally for thousands of years by many cultures, including ancient China, Japan, India, Rome, Greece, the Americas and the Middle East. The Roman heritage persisted in Europe and had been extended in the United States of America, until the first half of the 20th century. In addition to lavation and medical treatment, Roman baths were used also as resorts for relaxation and social contact—going to the bath regularly was regarded as

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an indication of higher social standing. Along with the progress in epidemiology and public health, hydrotherapy became more and more popular. Balneotherapy research started at that time as well. Modern hydrotherapy can be traced to the development of ''water cure'' spas in 19th century Europe [1]. Scientific research is limited in these areas, but controlled studies in balneology have notwithstanding been published in increasing numbers during recent decades. At the beginning of the twentieth century, balneotherapy enjoyed a much more distinguished status, than nowadays. Various gynecologic inflammatory disorders, postoperative adhesions and chronic inflammation are common despite state-of-the art therapy and have not been eliminated by treatment with the first choice approach (antibiotics or steroids). In these cases, balneotherapy may be chosen for second-line treatment.

The gynaecological application of balneotherapy is based on empirical and historic data, rather than on evidence. Notwithstanding this, traditional health resorts of the nineteenth and twentieth centuries also had gynaecological departments, along with other treatment facilities. Gynecologic balneology has a long tradition in Hungary. In 1891, the Hungarian Balneology Association was chaired by a gynecologist, and through decades, a department of gynecology has been functioning at Harkány Spa to make good use of its sulphuric water [2]. As shown by a survey conducted in Germany, 108 out of 481 gynaecological departments use balneotherapy; however, these were mostly located in the vicinity of health spas [3]. The increasing problem of antibiotic resistance and recurrences promptly following the discontinuation of steroids redirected attention to well-established methods (such as balneotherapy) affording a longer lasting, albeit less rapidly ensuing effect. An accurate diagnosis is never made in sixty per cent of cases with chronic pelvic pain, which is estimated to afflict sixteen per cent of women of reproductive age [4]. Although the incidence of chronic pelvic pain is 147/1000 in the female population aged between 18 and 50 years, only 25 per cent of these patients seek medical help to relieve their symptoms [5].

The incidence of chronic pelvic inflammatory disease (CPID), as well as of chronic pelvic pain is different in various age groups. In Hungary, approximately 50,000 cases of CPID are diagnosed in the female population of reproductive age. The most common causes of chronic abdominal pain include endometriosis, pelvic inflammatory disease (PID), and postoperative adhesions. In the USA, CPID is among the most common causes of hospitalisation among women of reproductive age [6]. However, pain resulting from irritable colon syndrome, interstitial cystitis, as well as from certain musculoskeletal and neurological disorders can also be accompanied by similar symptoms. Psychological factors should not be disregarded either. Furthermore, there are the ever-expanding groups of various hormonal problems and specific forms of neurosis, the management of which also involves balneo-climatology as an indispensable modality. A special therapeutic effect, which is not reproducible by pharmacotherapy, may be achieved by spa therapy. Pelvic inflammatory disease is treated on an inpatient or outpatient basis, depending on the severity of symptoms and balneotherapy could be added during rehabilitation period.

However, it is reasonable to ask whether the efficacy of balneotherapy has been convincingly demonstrated in gynaecology. Unfortunately, the answer is negative. In our era concentrated on evidence-based medicine, information on research into balneo-gynaecology is scarce in medical databases. Except for the abundance of reports in Russian and German [7–9] papers reporting on randomized controlled balneology studies in English are almost non-existent. In countries traditionally rich in thermal water (e.g. Germany, Turkey, France, Italy, Japan and Hungary), balneology is routinely used in the management of gynaecological disorders. Nevertheless, the majority of review articles published from these countries in the field of balneology discuss the treatment of musculoskeletal disorders and the rest focus on metabolic or dermatological diseases.

In Hungary, the Parádfürdő State Hospital is among the most reputable health institutions specialising in rehabilitation. The city of Parád is located in the northern highland of Hungary. As a climatic health resort, it has been an integral element of Hungarian spa culture since more than 250 years. In addition to modern equipment and contemporary therapeutic methods, the highly qualified staff of this institution also relies upon the use of unique thermal waters obtained from springs in the neighbourhood.

The objective of this study was to obtain evidence-based assertion that balneotherapy is of benefit in gynaecological disorders. This study was undertaken to answer the following questions: Can the beneficial effect of alum-containing water be demonstrated in chronic gynaecological disorders? Is there any difference between the clinical and laboratory parameters of patients undergoing balneotherapy with mineral versus tap water?

2. Patients and methods

Having obtained informed consent from the subjects, balneotherapy and the whole study were conducted in conformity with Good Clinical Practice (GCP) principles. Patients undergoing inpatient treatment were enrolled. Because of the strict inclusion and exclusion criteria, 42 patients were included, but only 40 actually started in the trial (two subjects withdrew for personal reasons); these were randomized (according to a computer-generated randomisation list) into two treatment groups of 20 patients each. All subjects underwent conditioning exercise, but no other form of physiotherapy, in groups. No drug therapy was administered during the study period.

Patients who met the inclusion criteria were randomized into either of two groups. One group was treated with

balneotherapy using alum-containing ferrous water, whereas the other bathed in tap water. In alum-containing water, sulphate is incorporated into a compound as a component and therefore, it has no strong sulphuric odour. Using water of high iron content for many years has caused brownish discolouration of bathtubs, which made it impossible for the patients to ascertain whether they were bathing in tap water or in alum-containing water. The investigator, however, knew which kind of water was in the bathtub. The duration of daily bath sessions (administered at the same time of the day) was 20 min; the temperature of the bath was 38 °C. All patients completed 10 treatments, administered every other day (sessions skipped during menses were substituted for). Mean age of patients was 34.5 ± 7.98 years in the treatment group and 35.3 ± 7.59 years in the control group; mean disease duration was 2 years. BMI corresponded to the values of the general population, i.e. it was 25.9 kg/m^2 (range: 21.2–27) in the treatment group and 26.2 kg/m^2 (range: 22–28) in the control group.

2.1. Inclusion criteria

Resolution of the acute inflammatory phase; conclusion of antibiotic therapy; follow-up pelvic examination findings; negative inflammatory markers upon laboratory testing.

2.2. Exclusion criteria

- Acute inflammatory and febrile conditions.
- Tuberculosis—for additional 2 years after the healing of the active stage.
- Decompensated heart failure.
- Severe anaemia.
- Severe endometriosis.
- Hepatitis—for an additional year after healing.
- Pregnancy.
- Severe mental disorders and epilepsy.

The composition of the mineral water is shown in Table 1. The mineral solute content of the tap water was negligible (iron: 4 mg/l; sulphate: 56 mg/l, pH 7.7, alkaline buffers: 1.6 mmol/l, CaO: 80 mg/l). CaO (calcium oxide) = hardness of water in mg/l.

2.3. Study parameters

VAS scores (on a 10-grade visual analogue scale) of the following [10]:

- Pain elicited during bimanual pelvic examination by handling the uterus, adnexae and the parametrium (patients indicated changes of pain on the VAS themselves, before the first and after the last treatment).
- Increment of tissue bulk as reflected by enlargement and induration of the adnexae and the parametrium upon bimanual examination (the adnexae and the parametrium are clearly discernible during the gynaecological examination, and therefore, these were appraised separately).
- Subjective symptoms, intensity of pain at rest, as well as perceived disease severity (as the complete lack of perceived disease and subjective symptoms is a prerequisite to establishing full recovery).

Table 1
The composition of mineral water—currently obtained by extraction from aluminous rock

Potassium	2.7 mg/l
Sodium	3
Ammonia	1.8
Calcium	161
Magnesium	52
Iron	275
Manganese	1.9
Aluminium	31
Chloride	23
Fluoride	<0.10
Sulphate	1140
Phosphate	5.22
Metaboric acid	7.5
Metasilicic acid	30
Solute oxygen	15.8
Arsenic	0.48
Barium	0.025
Total	1749 mg

Reproductive hormones (FSH, LH, prolactin and oestradiol) and beta-endorphin levels were determined by radioimmunoassay.

Pelvic colour-coded Doppler ultrasound examination (with a GE Logic 400 machine).

Pulsatility index of the uterine artery at baseline and after treatment.

2.4. Statistical analysis

First we checked between-group differences in the means of baseline parameters. We used independent-sample *t*-test and Levene's test for equality of variances. Then we checked the effects of treatments using factorial mixed-design two-way ANOVA (statistical software was SPSS, Version 15). Here we have one within-subject variable (time) with two levels (pre- and post-treatment), and one between-subjects variable (treatment) with two levels (mineral water and tap water). We performed this analysis for all dependent variables step-by-step and then summarized the results and conclusions. We always assumed a 5 per cent level of significance.

3. Results

Baseline parameters of the two groups were similar, except for a minimal difference – of borderline significance – between pelvic US pulsatility indices. Statistically

Table 2
The changes of clinical parameters

Measured factor	Independent *t*-test	Mixed two-way ANOVA		
	Difference of means of the measured factor between groups prior treatment (p)	Main effect of treatment (p)	Main effect of time (p)	Time × treatment interaction effect (p)
Pain elicited by handling the uterus	0.289	0.935	<0.001	0.009
Pain elicited by handling the adnexes	0.501	0.196	<0.001	0.330
Pain elicited by handling the parametrium	0.173	0.067	<0.001	0.746
Parametrial mass	0.348	0.151	<0.001	1.000
Adnexal mass	0.384	0.187	<0.001	0.916
General condition	0.275	0.059	<0.001	0.080
Psychic status	0.850	0.226	<0.001	0.010
Pain at rest	0.072	0.026	<0.001	0.563
US PI	0.049	0.073	0.088	0.291

significant improvement of all clinical parameters except the Doppler index was ascertained in both groups (Table 2). In the treatment group, the intensity of pain elicited by handling the uterus decreased and psychic status improved significantly, compared to controls. The improvement in the general condition of patients treated with mineral water almost reached the level of statistical significance (Table 2). Measurement of reproductive hormones and beta-endorphins according to the study protocol did not reveal any significant differences between the treatment and the control group.

4. Discussion

The clinical assessments clearly confirmed the beneficial effects of thermal water. The tentative mode of action is sophisticated [11,12]. On one hand, it includes mechanical stimulation by hydrostatic pressure, buoyancy and temperature, but tap water has all these properties. The existence of any chemical effect is largely unproven but there is some evidence for the absorption of trace minerals from thermal water [13]. The metabolic effect might be related to the beneficial action on free radicals, primarily [14]. The circulatory effect enhances microcirculation [15]. Through their favourable influence on the opportunistic microflora, mud and salt water assist restoration of the normal bacterial flora in patients with CIPD [16]. The analgesic effect, one of the greatest benefits of balneotherapy, is based on extremely complex mechanisms [17]. Elevation of endorphin levels is a potential contributing factor [18]. The anti-inflammatory effect of mineral water has been demonstrated during mud bath therapy for experimentally induced arthritis [19]. Reduction of the serum levels of inflammatory mediators (such as IL-1, PGE_2 and LTB_4) was observed after balneotherapy of patients with fibromyalgia—a rheumatologic disorder with an aetiology known to include psychic components [20]. The effect of heat itself can prove beneficial [21]. The beneficial effect of thermal water on immune functions has been confirmed by changes in monocyte activation [22].

The improvement of psychic status and the relief of pain elicited by handling the uterus demonstrated the superiority of alum-containing medicinal water over tap water. No changes of hormones levels were observed in our study. Presumably, the therapy consisting of only 10 treatment sessions was not stimulating enough to exert any detectable influence on the endocrine system. The unchanged Doppler index might indicate the lack of any pronounced, persistent and detectable vasodilatory effect of inert warm water on pelvic blood vessels.

Balneotherapy has gained popularity in the management of musculoskeletal disorders, primarily. An increasing number of well-controlled, randomized studies have evaluated its usefulness in this indication. Experience from short- and long-term studies is available both in inflammatory and degenerative disorders [23]. The advent of balneophototherapy extended its application to dermatology, although the beneficial effect of brine and sulphuric water in psoriasis, for example, has been known for decades.

The majority of gynaecological outpatients seek help for inflammatory disorders of the genitourinary tract. The diagnostic work-up of such cases is often needless and very expensive, all over the world. Inflammatory disorders of the upper genital tract and adjacent tissues mostly result from ascending infection. According to international data, the annual incidence of these disorders is 10–15‰ and the number of cases is increasing among females under the age of 30 years, when pelvic inflammatory disease is typically consequent on sexually transmitted diseases (STDs). Prevalence estimates vary between 63 and 250 per 10,000 person years at risk. In women over 30 years of age, however, endogenous factors play an increasingly important role. The widespread use of IUDs, sexual activity, reliance on sanitary pads, frequent irrigation and the enormous number of artificial abortions all contribute to the increasing incidence of pelvic inflammatory disease. Clinical manifestations include lower abdominal pain, asthenia, fatiguability, abnormal bleeding and micturition problems. The potential sequelae of pelvic inflammatory diseases are chronic pelvic pain, ectopic pregnancy and infertility and the prevalence of pelvic inflammatory disease between ages 35

and 39 (the average age of our patients) is 127/10,000. Recurrences after the conclusion of targeted antibiotic therapy are common and progress to chronic inflammation. Late sequels of the latter (infertility, chronic pelvic pain, and sexual dysfunction) afflict a vast number of women and as such, have an extreme economic and public health significance.

Timely recognition and appropriate management can eliminate these problems—alternative therapeutic modalities may include also balneotherapy [24]. Somatic abnormalities are commonly accompanied by psychic problems. Balneotherapy may prove extremely beneficial in such cases, as it improves the patients' quality of life [25]. Positive changes in psychic status were evident in both groups of our study population. In addition to the therapeutic intervention, the improvement of this subjective parameter might have been attributed to removal from the familiar environment, the climatic properties of the health resort and a variety of additional factors; notwithstanding these, improvement was even greater in patients undergoing treatment with mineral water.

The essential problem is that the medical profession is sceptical towards balneotherapy—and this is with good reason in the lack of the necessary evidence. Balneotherapy following the antibiotic treatment of salpingitis mitigated pain but did not influence intra-abdominal adhesions [26]. Another study into the gynaecological application of balneotherapy found arsenic-containing water effective (as shown by cytological evidence) in vulvovaginitis [27]. The climatic conditions of a given health resort, the change in the patient's environment, and relaxation all might exert a positive influence on the symptoms of women with CPID. Our study has shown that balneotherapy has favourable effect on the short term and accordingly, further studies are necessary to demonstrate the persistence of these benefits on the long term, as well as their existence in larger populations and different age groups of patients. Nevertheless, reporting these results has been deemed worthwhile in view of the meagre availability of evidence in the medical literature.

5. Conclusion

The results of our study, implemented in conformity with the protocol outlined above, seem to support the century-old experience that a 3-week balneotherapy course with the thermal water available at Parádfürdő (i.e. alum-containing ferrous water) may prove effective in the management of chronic inflammatory gynaecological disorders.

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