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TREATMENT OF TROPHIC LEG ULCERS WITH APPLICATION OF VARIABLE MAGNETIC FIELDS

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Abstract - The effect of treatment with extremely low frequency magnetic field (magnetotherapy) and weak microTesla variable magnetic field (magnetostimulation) in patients suffering from chronic, non-healing trophic leg ulcers is presented. The results of long-term exposure to magnetic field in form of subsidence of pain, purification of ulceration and stimulation of healing process indicate that both methods could be useful assisting methods of treatment of chronic leg ulcers, due to high therapeutic efficacy, lack of side effects, possibility of application together with routine pharmacotherapy and occlusive dressing, also in out-patient conditions, as well as facility of attendance of the devices.

I. INTRODUCTION

Taking into account the theoretical considerations and the results of experimental studies at the end of twenties century first clinical trials regarding application of extremely low frequency variable magnetic fields called magnetotherapy in the treatment of trophic leg ulcers were performed [1], [2]. In last 10 years a new method of treatment with use of microTesla variable magnetic field basing on ion cyclotron resonance mechanism called magnetostimulation is also applied in the complex therapy in those cases [3].

In magnetotherapy variable magnetic field with sinusoidal, triangular or rectangular shape of impulses, frequency of impulses below 100 Hz and induction of the magnetic field in range 0.1-20 mT are applied, while in magnetostimulation variable magnetic field with the saw tooth-like shape of basic impulses, frequency of basic impulses in range 150-200 Hz, that of overlapped clustered impulses in range 12.5-29 Hz, 2.8-7.6 Hz and 0.08-0.3 Hz, and effective induction of the magnetic field below 100 μ T are used [4].

Actually the following biological effects making a basis for clinical application of variable magnetic fields in the treatment of trophic leg ulcers are described and reliably confirmed: intensification of the process of oxygen utilization and tissue respiration, dilation of blood vessels and stimulation of angiogenesis, intensification of tissue regeneration process, inhibition of secondary infections (antibacterial effect), anti-inflammatory and antiedematous effect, analgesic effect, anticoagulative action, as well as advantageous influence on the course of general and local complications of diabetes [4].

The aim of the paper was to present our own clinical experience with application of magnetotherapy and magnetostimulation in the treatment of chronic, non-healing trophic leg ulcers of different origin.

II. MATERIAL AND METHODS

A. Patients

In the trial 182 patients (123 women and 59 men) at age of 31-84 years were involved. All patients suffered from chronic, non-healing trophic leg ulcers of different etiology (128 cases of vascular (venous) lesions, 45 cases of diabetic angiopathy and 9 cases of post-traumatic lesions). In most of the patients ulcers were located on one leg and in 8 patients on both legs. Most of the patients had single ulcer and only 26 patients had numerous ulcers, however in all patients the ulcers were located on lower 1/3 part of a leg. In particular patients the longest dimensions of the largest ulcer were in the range of 10-125 mm (the average 55 mm). In 29 patients accompanying strong pains were observed, while in remaining patients the pains were weaker or they were not present. Before the beginning of magnetotherapy or magnetostimulation cycle all patients were unsuccessfully treated with routine methods through 2-18 months.

B. Procedure of magnetotherapy and magnetostimulation

Depending on the applied therapeutic method and parameters of variable magnetic field all patients were randomly divided into 2 groups. Patients from the first group (132 persons) were treated with use of magnetotherapy, during which they were exposed to extremely low frequency magnetic field with rectangular and triangular shape of impulses, frequency of impulses 5 Hz and induction of the magnetic field 15 mT. In turn the patients from second group (50 persons) were treated with use of magnetostimulation during which they were exposed to variable magnetic field with the saw tooth-like shape of basic impulses, frequency of basic impulses in range 180-195 Hz, that of overlapped clustered impulses in range 12.5-29 Hz, 2.8-7.6 Hz and 0.08-0.3 Hz, and effective induction of the magnetic field 80 μ T.

In both groups patient's legs were placed inside of a typical cylindrical applicator with diameter of 50 cm. Exposures were continued 2 times daily for 12 minutes, 5 days a week, until the complete epithelialization of the ulcer was obtained.

During the therapeutic cycle no routine in such cases dermatological treatment was performed except of procedures necessary for keeping sterility of ulceration.

III. RESULTS

The course of the reaction for therapy with use of variable magnetic field and obtained results were similar in both groups of patients. However in patients exposed to extremely low frequency magnetic field during magnetotherapy more intense analgesic and anti-inflammatory effect was observed, while in patients treated with magnetostimulation more effective process of epidermization occurred.

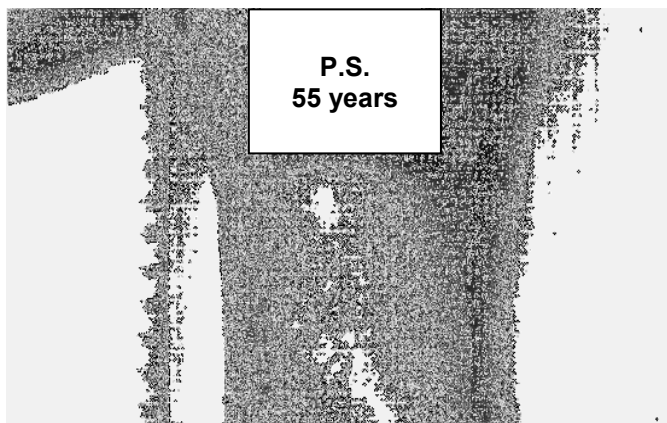


Fig.1. 62-year old patient – ulceration lasting for 8 month at the moment of beginning of magnetotherapy – local status before treatment

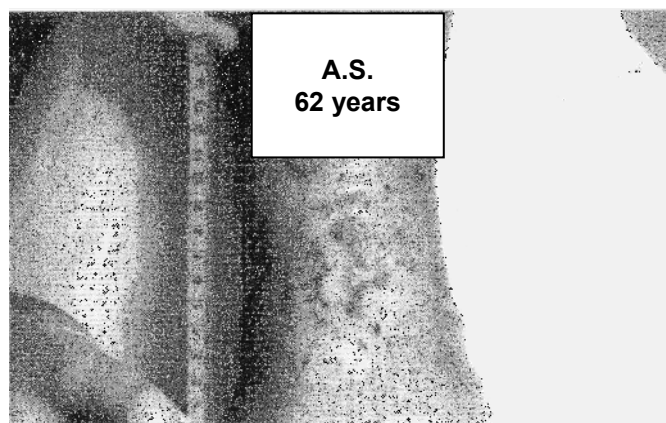


Fig.3. 62-year old patient – ulceration lasting for 8 month at the moment of beginning of magnetotherapy – local status before treatment

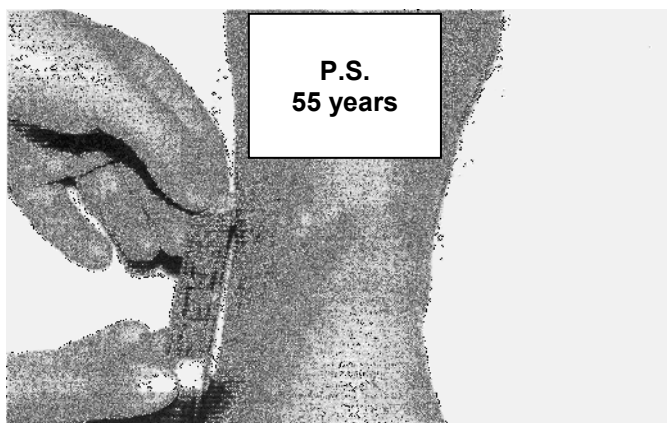


Fig.2. The same patient – complete healing of ulcer obtained after 60 exposures to variable magnetic field

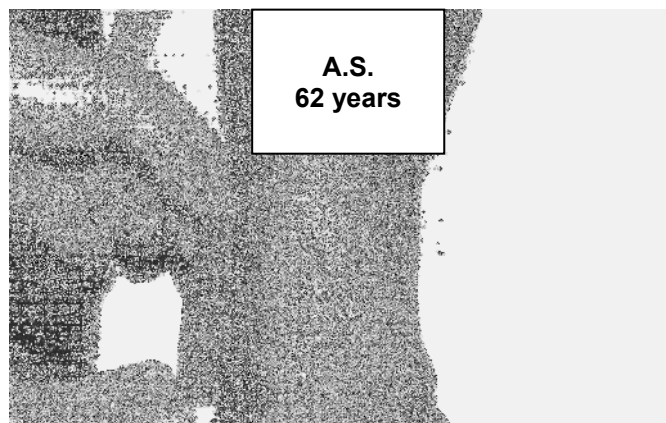


Fig.4. The same patient – complete healing of ulcer obtained after 60 exposures to variable magnetic field

In most of the patients the earliest therapeutic effect, observed after about 7-10 exposures, was purification of the ulceration from the purulent patch. Next laudable pus appeared and gradually typical putrescent smell disappeared. In this period the disappearance of pain in all patients suffering from his complaint was also observed.

After about 15 exposures a significant reduction of the swelling and quantity of the laudable pus secreted by wound was obtained. A fine-granular, pink granulation also appeared, that gradually became covered with a scab. After about 20 exposures on the margin of the wound a limbus of epidermis developed, and then the process of epidermization proceeded under the scab, which after separation was replaced by a new epidermis. Since that moment a significant reduction of dimensions of ulcer was observed. At the same time in 35 patients the improvement of blood supply with regaining of normal pigmentation of skin in the region of ulceration was observed. The complete epithelialization of ulcer was obtained in 24 patients after 40 exposures, in 32 patients after 60 exposures, in 47 patients after 75 exposures, and in 19 patients after 90 exposures. In 5 patients, who discontinued treatment due to some reasons not related to the course of therapy, no significant improvement of clinical status was observed. In turn in 18 patients, who discontinued therapy after 40-75 exposures, in spite of lack of complete healing, a significant subjective improvement and a distinct reduction of the dimensions of ulcer was noticed.

During therapeutic cycle in none patient from either groups no significant complications or side effects were observed.

IV. CONCLUSIONS

On the basis of the results obtained in presented patients one can conclude that both magnetotherapy and magnetostimulation are useful supplementary methods in the complex treatment of patients suffering from chronic, non-healing, trophic leg ulcers of different etiology, especially due to high therapeutic efficacy, good toleration by patients and lack of side-effects. Both methods could be applied together with routine pharmacotherapy and occlusive dressing (as variable magnetic field completely penetrates all tissues of human organism), and due to small-sized dimensions as well as facility of attendance of the devices they could be used also in out-patient conditions.

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