

Analgesic properties of electromagnetic field therapy in patients with chronic pelvic pain

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Summary: AIM - demonstration of analgesic effects of electromagnetic field treatment in cases of chronic refractory pelvic pain.

STUDY DESIGN: prospective non-controlled trial, 64 women complaining about pelvic pain of at least 6 months duration, resistant to standard therapies, submitted to electromagnetic field applications on both iliac regions by Thelf Systems apparatus by two applications daily lasting 2 hours each for 20-40 days. Control visit after 3 months.

RESULTS: complete subsidence of pain in 39 cases (61%), in 15 patients (23%) relief during treatment, then mild endopelvic tension after a 3-month control; in 10 cases (16%) symptoms reduced only during application hours, unchanged at follow-up. Outcome of treatment appears to be independent of pre-existent psychosocial variables.

CONCLUSION: magnetic therapy shows a real analgesic effect on pelvic pain, and seems to contribute to resolution of complex interactions between somatic nociceptive stimuli and psychosocial implications affecting pain perception in these patients.

Key words: Chronic pelvic pain; Electromagnetic fields; Analgesic therapy.

INTRODUCTION

Magnetic forces and their biological effects have been known since antiquity. Their use for therapeutic purposes traces back to the ancient Egyptians. Hippocrates (500 BC), the most famous member

of the Kos' School, even introduced magnetite into Obstetrics to cure sterility. In addition, Cain Pliny the Second (23-79), in the *Historia Naturalis* names magnetite as a treatment for bloody vaginal discharge and for metrorrhagia. In the Middle Ages studies about the medical use of magnetite increased. The establishment of the Royal Society of English Magnetic Therapy dates back to 1680. Around 1723, Claisault succeeded in making artificial magnets. In 1777, Le Noble introduced the first artificial magnet to the medical association.

We owe the discovery of many electrodynamical phenomena, to A.M. Ampère

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(1775-1836) including the relationship between circulating currents and the magnetic fields produced, and furthermore, we owe experience about fundamental phenomenon of electromagnetics to H.C. Oersted (1777-1851).

In the fifties the Japanese, Fukuda and Yasuda, and the American, Basset (¹) described the electrochemical properties of collagen protein liquid crystals and the piezoelectric behaviour of bone substance.

During the sixties several studies about the influence exerted by magnetic fields on the animal and vegetable world were carried-out. Insects, such as flies, termites, cockchafers, migratory birds and pigeons, were directed by the terrestrial magnetic field (^{2, 3}). It has been possible to change guinea-pigs' orientation, immunological faculties, and haematologic parameters by subjecting them to the influence of electromagnetic fields (^{4, 5, 6}).

For a long time it was believed that a strict relation between electric and magnetic phenomena did not exist, until Oersted demonstrated how a wire with an electric current running through it produces a magnetic field which assumes the same characteristics of the current by which it is produced (constant or variable, intensity, etc...). Therefore, the electromagnetic field is composed simultaneously of two force fields with different characteristics: one electric and the other magnetic. In a given instant "A" two vectors, HM (magnetic) and HE (electric), perpendicular to each other, result in being in a plane also perpendicular to the energy propagation line SX. Their value changes in time to return periodically to an initial value; this time is called cycle. The number (N) of cycles per second is called frequency (F) of emission. The propagation velocity C in a vacuum or in air is equal to the velocity of light (300.000 km/sec.). Frequency and wave length (in km) are inversely proportional and linked by the following formula: $C/F = 3 \times 10^8 / F$ (in m/sec.).

By analysing the electromagnetic wave spectrum, it is possible to observe X-rays and gamma-rays at high frequencies, and as the frequency decreases (and the wave length increases) UV-rays and the visible light spectrum. Going backwards we can observe micro-waves and radio-waves (called Hertziene waves from 0.5 to 500 MHz, divided in HF VHF and UF) to end in the lower frequencies from 30 KHz to 3 KHz, indicated as VLF, ELF, and ULF.

General magnetic biological effects and their therapeutic application are still the subjects of many studies and research. In the last 50 years interesting clinical results have been achieved in disparate pathologies (^{7, 8, 9, 10}).

In our experience we used the *Thelf Systems* apparatus (Topical High frequency Electromagnetic Fields). It emits high frequency (27,1225 MHz) electromagnetic waves at a low intensity (from 1/22 to 1 Gauss) with an emission of very short irradiation flashes separated by free intervals. Each group of waves (Burst/sec.) lasts 65 microseconds, separated by different intervals from 1,000 to 10,000 microseconds, according to the frequency pulsation used. Such frequency of rectangular impulses is produced by a current HF that runs through a flexible emitting antenna with the aim of conforming the treated section of the electromagnetic field in the required way. The impulse repetition frequency can range from 5 to 640 burst/sec. There are 4 types of emission power: H (High power: 18 Watt), L (Low power: 7 W), H-SP (High power with 3 0W spikes for 2 microseconds), L-SP (Low power with spikes). A very low intensity use determines an "athermic" electromagnetic therapy, in spite of the high frequency, as the field is mostly magnetic (not less than 90%); in addition, during the emission rest interval, the free power is absorbed so as to eliminate the condition of hyperthermic complications.

Therefore, heat loss does not occur in spite of what happens to all other types of electromagnetic waves used in therapy (radar, infrared, etc...). An important characteristic of the Thelf System Apparatus is that the electromagnetic fields produced have a very similar frequency to the protein resonance frequency (50-250 MHz). Such a characteristic represents the basis of an important biological effect that is the uniform orientation of the protein electric dipoles in accordance with the electromagnetic field; the deep penetration of these waves in the tissue has been estimated to be around 12-15 cm. Considering the relation existing between the frequency and power penetration in the tissues, we can deduce that the latter depends on the frequency and not on the power supplied.

The aim of the study was to verify the analgesic and anti-inflammatory properties of electromagnetic fields in relation only to pelvic pain.

MATERIALS AND METHODS

Sixty-four patients, aged 20 to 47, complaining for at least six months of pelvic pain, without remission by medical therapy and independent of other symptoms, such as dysmenorrhea, dyspareunia or leucorrhea, were enrolled in the study. All patients underwent gynecologic examination, cervical cytology, wet-mount smear for bacterial microscopic examination, and pelvic ecography. In case of vaginal infection the patient was admitted for treatment after remission of the cervical-vaginal disorder. Indications for surgical intervention were excluded, such as ovarian or uterine masses, and laparoscopy was performed when indicated. Ultrasound controls were performed before and after therapy. The therapy was carried-out by applying antennae of the Thelf Systems apparatus in the right and left iliac regions. The following frequencies were used: 64 HPS the first hour and 320 HPS the second hour. Treatment was performed daily by two applications lasting 2 hours each for a variable time from 20 to 40 days.

Patients were followed-up 3 months after suspension of the therapy.

RESULTS

Complete subsidence of pain was obtained in 61% (39 cases), 15 patients (23%) had relief of pain during treatment, while during the three-month follow-up an irregular endopelvic tension was complained about in 10 cases (16%) the symptoms were reduced only during the application hours, remaining unchanged after therapy suspension.

The data are intentionally lacking from the diagnostic point of view, as we wanted to study the analgesic properties of electromagnetic fields leaving the pathogenesis out of consideration. On the contrary, we considered the psychosocial variables, according to the biopsychological model of chronic pelvic pain⁽¹¹⁾.

Table 1 reports all data relative to somatic symptoms and pre-existent psychosocial variables, in terms of pain severity, disability, inappropriate health care utilization, substance abuse, depression, marital adjustment, and anxiety, related to the outcome of magnetic field therapy. We considered as a positive outcome not only the complete subsidence of pain, obtained in 39 cases, but also a significant reduction of discomfort, reported at the 3-month follow-up by an additional 15 patients (positive outcome total = 54 patients).

No significant complications of electromagnetic field application occurred during the treatment, and neither did patients report any kind of consequences at the control visit.

DISCUSSION

The high prevalence of Chronic Pelvic Pain and its relevant physical and psychological implications make this syndrome a primary health concern of women⁽¹²⁾.

Definition of Chronic Pelvic Pain (CPP) may be assumed as "noncyclic abdominal and pelvic pain of at least 6 months duration"⁽¹³⁾.

Table 1. — Outcome of magnetic field therapy in 64 patients, and correlation with somatic and psychological factors present before treatment (statistical analysis by 2×2 contingency tables with Fisher's exact test, two-sided *P* value is considered significant if < 0.05).

	MAGNETIC FIELD THERAPY		Fisher's exact test	Relative risk	95% confidence interval (Katz)
	Negative outcome (pain unchanged at 3-month control) Total = 10	Positive outcome (complete or significant relief of pain) Total = 54			
Pain severity	6	10	$P = 0.0117$	4.5	(1.4 - 13.9)
Disability	4	6	$P = 0.0415$	3.6	(1.2 - 10.5)
Inappropriate health care utilization	2	6	$P = 0.5999$	1.8	(0.4 - 6.8)
Substance abuse	6	19	$P = 0.1702$	2.3	(0.7 - 7.5)
Depression	7	24	$P = 0.1780$	2.5	(0.7 - 8.8)
Marital adjustment	3	14	$P = 1.0000$	1.2	(0.3 - 4.1)
Anxiety	8	33	$P = 0.3078$	2.2	(0.5 - 9.7)

Approximately 10% of all outpatient gynecologic consultations and one-third of laparoscopies are due to chronic pelvic pain (¹⁴). In fact, assessment and management of this condition appear to be particularly complicated, considering that even the detection of specific organic causes sometimes fails. The most frequent identifiable causes of CPP are linked to endometriosis, pelvic inflammatory disease, gastroenterologic conditions (such as irritable bowel syndrome), urogynecologic causes, muscular skeletal origins, and, finally, in a small percentage of cases, no identifiable symptom source is apparent (¹¹).

Apart from the difficult diagnostic process, the etiological diagnosis often does not lead to successful treatment. Even hysterectomy has been frequently performed for this indication, without any controlled trial evaluating its long-term effectiveness. Moreover, one quarter of patients referred for CPP have previously undergone a hysterectomy without any significant symptom relief (^{15, 16}).

The solution of this clinical problem may be grounded on a multidisciplinary approach to chronic pelvic pain, as stated

by Milburn, *et al.* (¹¹). The classical medical model of pain perception (Cartesian model) is based on the direct proportion between pain and tissue trauma. Identification and resolution of the source of tissue injury is necessary for the relief of pain. On the contrary, the gate-control theory of pain proposed by Melzack (^{17, 18, 19}) describes the integration of peripheral stimuli with cortical variables, such as mood and anxiety, in the perception of pain. The so-called biopsychosocial model of chronic pain also takes into account adverse clinical and social outcomes such as the reciprocally determined results of the complex interaction between chronic nociceptive stimuli and multiple psychological and social determinants (¹¹).

In our experience, following the failure of standard pharmacological therapies, the approach has been based on the eradication of the symptom "pain" by using an alternative procedure and creating a great expectation of pain relief in patients.

From the analysis of our data it appears evident that in patients who benefited from the magnetic field therapy the favourable outcome was independent of the previous psychosocial status. On the

contrary, the pain relief contributed in resolving many problems linked to anxiety, somatization, dyspareunia, etc., probably breaking the reciprocal interactions between chronic nociceptive stimuli and psychosocial determinants.

Obviously, a proportion of the benefit of the proposed treatment on pain perception is not dependent on the direct physical effect of magnetic fields on the cells, but it can be ascribed to a placebo-effect – a reciprocal positive interaction between the reduction of pain and improvement of the psychological status.

These thoughts do not lessen the promising role that electromagnetic field therapy could play in refractory chronic pelvic pain, which includes a multidisciplinary management that must not underestimate the importance of the psychological approach.

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