Clinical Research on Foot & Ankle

Review Article Open Access

Treatments with Magnetic Fields for a Participant with Type I Complex Regional Knee Osteoarthritis

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Abstract

Complex regional pain syndrome (CRPS) is a neurologic chronic pain condition that can have a significant impact on quality of life and is difficult to diagnose and treat. Right now, the accessible multimodal, individualized medicines (i.e., pharmacological and non-pharmacological treatments including obtrusive techniques) are pointed exclusively at side effect control. We present the case of a Caucasian woman, 69 years old, who presented to us with a 3-year history of severe (10/10) burning pain in her right ankle, oedema, and local changes in temperature and color of the skin after the ankle sprain. Due to multiple drug intolerance, previous pharmacological attempts were unsuccessful. Clinical assessment affirmed the CRPS type I finding, and a week after week diamagnetic treatment convention was begun since the patient declined further meds and interventional systems. A significant (p 0.01) reduction in pain intensity and absence of oedema (difference in ankle circumference:) after 10 weeks of treatment from 3 cm to 0) were observed, with no adverse events and consequently improved quality of life. Our case report suggests further investigation of the potential use of diamagnetic therapy as a non-invasive and safe adjunctive treatment for CRPS and as an alternative when patients did not benefit from drugs or refused invasive procedures, despite the lack of high-quality clinical evidence.

Keywords: Algodystrophy; Crops; Drug intolerance; Magnetic fields; Physical therapy

Introduction

Painful and persistent neurologic condition known as complex regional pain syndrome (CRPS) can have a significant psychological and functional impact on quality of life. Although a small but not insignificant percentage of patients (up to 10%) may have no inciting events, CRPS typically manifests in a distal extremity following acute injury (primarily trauma and surgery) [**1**]. In addition to sensory (hyperalgesia and/or allodynia), vasomotor, sudomotor, and motor/trophic signs and symptoms, CRPS is confined to a body region and characterized by persistent pain that has no dermatomal distribution and is disproportionate to any inciting event. It can be divided into two subtypes based on whether a specific nerve lesion is present or not: respectively, CRPS I and CRPS II. The pathophysiologic mechanism behind its onset has not yet been fully understood, despite advances in knowledge. Maladaptive pro-inflammatory response, autonomic dysfunction, altered somatosensory representation in the brain, and increased peripheral and central sensitization all appear to play a role in CRPS. Additionally, psychological factors and genetic predispositions may influence the progression of CRPS [**2-5**].

The goal of CRPS treatment is to control symptoms, and it is determined for each patient based on the severity, duration, and functional and psychological impact of the symptoms. Physical, occupational, and psychological therapies should be combined with pharmacological treatments like bisphosphonates, non-steroidal anti-inflammatory drugs for neuropathic pain, and interventional procedures like sympathetic nerve blocks, spinal cord stimulation, and dorsal root ganglion stimulation [**6**].

Over time, the potential applications of pulsed electromagnetic fields (PEMFs) in biophysical therapies have expanded to include wound healing and an increasing number of muscle-skeletal disorders. Due to their non-invasiveness, safety, and efficacy, PEMFs appear to be a promising treatment option for many diseases of the muscles and skeleton as a stand-alone or adjunctive option. From a physics perspective, pulsing current produces PEMFs, which are nonionizing, nonthermal, low-frequency dynamic fields with particular waveforms and amplitudes. They have been shown to be effective in treating inflammatory disorders, particularly at frequencies below 100 Hz, as well as reducing pain and enhancing motor function. However, a number of hypotheses have been put forth regarding the precise mechanism by which PEMFs exert their effects at the cellular and molecular levels. At the cellular level, high-intensity, low-frequency PEMFs appear to be able to alter the ion balance and membrane exchanges, as well as propagate their effects through signal transduction pathways that have an impact on cellular functions (such as differentiation, proliferation, and interaction with extracellular matrix and other cells) [**7**].

The biophysical stimulation that is carried out with high-intensity, low-frequency PEMFs is also referred to as diamagnetic therapy because they also allow the exploitation of the water repulsive effect of diamagnetism on biological tissues and move water, ions, and molecules. As a outcome, diamagnetic therapy is also used to treat patients.

We present a 69-year-old Caucasian woman who was successfully treated with diamagnetic therapy after three years of suffering from CRPS and multiple drug intolerances [**8-10**].

Case Presentation

Due to a 3-year history of severe burning pain in her right ankle, oedema, alternating periods of color changes (reddish or bluish) and/or temperature, and a 69-year-old Caucasian female patient with a BMI of

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Received: 06-Dec-2022, Manuscript No: crfa-22-83343, **Editor assigned:** 08-Dec-2022, PreQC No: crfa-22-83343 (PQ), **Reviewed:** 22-Dec-2022, QC No: crfa-22-83343, **Revised:** 24-Dec-2022, Manuscript No: crfa-22-83343 (R), **Published:** 31-Dec-2022, DOI: 10.4172/2329-910X.1000381

Citation: Kevin C (2022) Treatments with Magnetic Fields for a Participant with Type I Complex Regional Knee Osteoarthritis. Clin Res Foot Ankle, 10: 381.

22.49 and weight 65 kg Since the beginning of these side effects, which happened after a lower leg sprain, she revealed being restricted in work and exercises of day to day living. The seriousness of her aggravation was 10/10 on a numeric rating scale (NRS), with a difficulty to endure any mechanical excitement, including tactile feeling from dress or covers. She also said that she had trouble sleeping, especially having trouble falling asleep.

The patient had bilateral hallux valgus, calcaneal spurs, cervical and dorsal spondylosis, arthrosis in genu varum (treated with intra-articular hyaluronic acid injection), and arterial blood hypertension (treated with bisoprolol 1.25 mg OD and valsartan 80 mg OD).

Two years ago, a diagnosis of CRPS type I was made. She had received treatment from a large number of steroidal and non-steroidal anti-inflammatory medications, each of which had provided her with a modest clinical benefit. However, all therapeutic endeavors had been abandoned due to the occurrence of untolerable adverse events, primarily gastrointestinal in nature. Besides, a convention with bisphosphonates (i.e., a once-day intravenous implantation of neridronate 100 mg like clockwork, 4 all out mixtures) has not been finished, because of an alluded drug prejudice. Various physiotherapy treatments, primarily TECAR therapy, also failed to alleviate pain and improve motor function.

Finally, acetaminophen (1000 mg as needed) was used on occasion, with limited pain control (NRS: 10).

The patient's limping walking was observed. In addition to peri-malleolar oedema and an asymmetric skin color, the right ankle had a difference in circumference of 3 cm major in comparison to the left. In the right ankle, clinical examination revealed a weakness, hyperalgesia, and allodynia without differences in skin temperature or tropism or dermatomal distribution. A particular nerve sore was precluded through the evaluation of both actual assessment and clinical documentation and utilizing the Budapest standards the finding of CRPS subtype I was affirmed. The CRPS type I patient's quality of life was measured using the Italian-validated version of the SF-36 questionnaire, which showed the lowest scores for bodily pain, physical functioning, and role limitations due to physical health and emotional issues.

The patient refused to begin a pharmacological treatment because of drug intolerance and hypersensitivity. Thusly, bio-exercise based recuperation was proposed, and a meeting of diamagnetic treatment was anticipated ten weeks. The patient was kept in a sitting position throughout the 25-minute weekly sessions of treatment. A combination of the clinician's and the manufacturer's pre-specified protocols were applied to the diamagnetic pump.

Discussion and Conclusions

The effects of diamagnetic therapy on CRPS in an elderly woman with multiple drug intolerance are discussed in this case report. According to previous research, female gender and extremity injury are both risk factors for the onset of CRPS. Our patient has a history of injury, which probably led to the development of this clinical condition in this instance. Numerous patients suffer poor outcomes, including persistent symptoms, chronic pain, and disability, despite the availability of various therapeutic approaches. which, in turn, have a negative impact on quality of life Patients with this syndrome score lower on questionnaires assessing quality of life than patients with other chronic pain conditions, primarily in the physical domains, due to the significant impact of the functional limitations associated with CRPS. Low scores for bodily pain, physical functioning, and role limitations due to physical health and emotional issues confirmed our patient's negative impact on quality of life. We did not include the impact on sleep quality in either the discussion or outcomes because it was only reported as qualitative information and was not quantified using a validated scale.

There is currently a lack of knowledge regarding the prognostic factors that could distinguish between patients with favorable outcomes and those with poor outcomes. New effective and non-invasive strategies are required, particularly for patients who are unable to benefit from pharmacological therapy (due to intolerance or ineffectiveness), as there is no successful "one-size-fits-all" approach. Because (i) the patient had multiple drug intolerance, a clinical entity that is frequently misdiagnosed and under-reported, and (ii) she refused to undergo interventional procedures, such as sympathetic nerve blocks, it was necessary to establish a non-pharmacological treatment in our case. It was also thought that the failure of previous physiotherapy protocols would lead to the development of a different kind of therapy that might be beneficial to her.

Findings suggest that, among other things, PEMFs may stimulate the production of the extracellular matrix and the differentiation of mesenchymal stem cells in osteoblasts, supporting the use of PEMFs in muscle-skeletal disorders.

The lack of a complete understanding of the pathogenesis of CRPS and the obvious difficulties in comparing suffering patterns and pain severity between patients and animal models make it difficult to identify new therapeutic targets for CRPS and evaluate their efficacy. A recent literature review looked at in vitro and in vivo studies on the effects of PEMFs on local osteoporosis and inflammation, which are currently the main therapeutic targets of CRPS, to support the use of PEMFs in treating the condition. PEMFs boost the expression of A2A and A3 adenosine receptors in chondrocytes, fibroblasts, and neurons, respectively, which is the primary mechanism by which PEMFs combat phlogism. Preclinical research suggests that PEMFs affect microcirculation, increasing microvascular perfusion, which could account for the anti-oedema effect observed in our patient. There may also be effects on the local immune pathologic response when the magnetic flux density is in the milli tesla range (86 mT in our case). In addition, pro-inflammatory cytokines, such as those involved in the rapid bone turnover and osteoporotic changes that occur during the chronic phase of the disease, are decreased by PEMFs. Regarding their effects on osteoporosis, PEMFs activate soluble adenylyl cyclase, cyclic adenosine monophosphate (cAMP), protein kinase A, and cAMP response element-binding protein (CREB) signaling pathways, which in turn encourage the proliferation and differentiation of osteoblasts. On the other hand, they stop bone resorption through a number of different ways, like making osteoclasts die and lowering the expression of carbonic anhydrase II and nuclear factor B (RANK) genes.

A small-scale, randomized controlled trial (RCT) in which PEMFs were used in addition to calcitonin and stretching exercises in patients who developed CRPS type I after a Colles fracture is the only study to date specifically aimed at evaluating PEMFs effectiveness as a single or combined treatment for CRPS type I. The visual analogue scale scores of pain at rest, pain during activity, and range of motion were not statistically different from those of the placebo group. Even though the data were derived from an RCT, the evidence was downgraded to low quality due to the trial's high risk of bias. This study was evaluated in a Cochrane systematic review that focused on physiotherapy measures for CRPS. The review came to the conclusion that there was low-quality evidence that PEMFs are not superior to placebo for the treatment of

pain or range of motion in patients suffering from CRPS type I. Our patient has benefited from diamagnetic therapy as a single treatment, despite the lack of high-quality clinical evidence and findings to support the use of PEMFs only as an addition to the pharmacological treatment of CRPS. In point of fact, we observed the disappearance of oedema and the reduction in the severity of pain (NRS from 10 to 2) following the treatment protocol, with consequent improvements in quality of life and no adverse events, following the failure of previous non-pharmacological therapies and the inability to begin any additional pharmacological attempts or interventional procedures. However, the fact that they referred to a single patient's experience highlights the limitations of our findings. In the past, making hypotheses and recommending new treatment options relied heavily on observing a single patient. Case reports helped to identify and describe new clinical entities, like the first cases of pneumonia that were reported in Wuhan in 2019 and were later linked to a novel coronavirus. in addition to the detection of both beneficial and harmful drug side effects. In this regard, some drugs have been taken off the market (such as thalidomide, appetite suppressants, and nonsteroidal anti-inflammatory drugs) and others have been given new therapeutic uses (such as sildenafil and bupropion). As a outcome, a single clinical observation can enhance our understanding of the etiopathogenetic, clinical, and therapeutic aspects of diseases, particularly those that are thought to be uncommon, and has "high sensitivity for detecting novelty." However, it lacks "lesser specificity for medical decision making and validation with a larger cohort of patients with a requirement for long-term follow-up." PEMFs have been shown to have dose-dependent effects, which should be taken into account when developing a treatment plan. Currently, clinicians manage parameter selection in terms of frequency, intensity, and exposure time because there are no standardized clinical protocols.

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