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Possibilities of Physical Medicine in the Treatment of Median Nerve Paralysis – Case Report

Możliwości medycyny fizykalnej w leczeniu porażenia nerwu pośrodkowego – opis przypadku

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Abstract

Introduction. Post-traumatic lesions of peripheral nerves prove to be extremely difficult in treatment and planning rehabilitation. Most frequently, those lesions have been caused by accidents or other circumstances. The lesion severity degree and consequences may be very substantially. This execution usually operating intervention with following rehabilitation. The recent years this is the dynamic development of method from physical medicine which more and more often help led treatment.
Case Report. The case study presents the result of treatment with use of spatial magnetic field in two patients (51 year-old and 31 year-old) after trauma injury-induced injury of the upper extremity with subsequent paralysis of median nerve.
Discussion. In the course of therapy, provided in outpatient clinic, the patients underwent a 45-day cycle of procedures with the use of generator for spatial magnetic field therapy. Before admission to the Clinic, the patient had undergone outpatient treatment, without satisfactory results. The therapy applied using spatial magnetic field, created optimum conditions for regeneration and reinnervation of damaged nerves, leading to improved functional condition of treated patients.
Conclusions. In the treatment of trauma injury of peripheral nerve important is introduction the proper treatment and the rehabilitation. Utilization of new apparatus, also the apparatus to spatial magnetic fields can in future support treatment and also accelerate their return to health. **(JNNN 2015;4(3):117–120)**
Key Words: median nerve paralysis, treatment, physical medicine, spatial magnetic fields

Streszczenie

Wstęp. Pourazowe uszkodzenia nerwów obwodowych stanowią niezwykle trudny problem w leczeniu oraz planowaniu rehabilitacji. Najczęściej uszkodzenia te spowodowane są przez tzw. nieszczęśliwy wypadek lub inne okoliczności. Stopień ciężkości uszkodzenia i jego następstwa mogą być bardzo różne. Wymaga to zazwyczaj przeprowadzenia zabiegu operacyjnego z następową rehabilitacją. Ostatnie lata to dynamiczny rozwój metod medycyny fizykalnej, które coraz częściej wspomagają prowadzone leczenie.
Opis przypadku. W artykule przedstawiono wyniki leczenia z wykorzystaniem przestrzennego pola magnetycznego u dwóch pacjentów (51 lat i 31 lat) po urazowym uszkodzeniu kończyny górnej z następowym porażeniem nerwu pośrodkowego.
Dyskusja. Do leczenia wykorzystano aparat do przestrzennego pola magnetycznego wykonując 45 zabiegów podczas całej sesji terapeutycznej. Dotychczasowe leczenie pod postacią wcześniej wdrożonych zabiegów fizjoterapeutycznych nie przyniosło w pełni zadowalających efektów. Zastosowanie terapii wykorzystującej przestrzenne pole magnetyczne stworzyło optymalne warunki regeneracji i reinerwacji uszkodzonych nerwów zmierzające do poprawy stanu funkcjonalnego leczonych chorych.

Wnioski. W leczeniu urazowych uszkodzeń nerwów obwodowych ważne jest wprowadzenie właściwego leczenia wspartego rehabilitacją. Wykorzystanie nowych urządzeń, w tym także terapii przestrzennym polem magnetycznym może w przyszłości wspomóc leczenie, a także przyśpieszyć ich powrót do zdrowia. **(PNN 2015;4(3):117–120)**
Słowa kluczowe: porażenie nerwu pośrodkowego, leczenie, medycyna fizykalna, przestrzenne pole magnetyczne

Introduction

Lesions of peripheral nerves in upper extremities pose an extremely difficult medical and therapeutic problem [1]. Most often, those lesions have been caused by mechanical trauma, compression of vessels surrounding the nerve, ischaemic process, or secondary inflammation [1,2].

In case of damage occurring to median nerve injury suffered at the arm level leads to total paralysis of the nerve. A dominating symptom in such cases is very severe sympathalgic pain and intensified vegetative symptoms. Additionally, such lesions lead to paresis or paralysis, and subsequently to atrophy of muscles innervated by that nerve. Motor-related symptoms are usually preceded by dysaesthesia, paraesthesia, and hyperaesthesia [3,4].

The basic method of treatment in case of trauma-induced lesions of peripheral nerves is surgical procedure [5,6]. In conservative therapy, the most frequently treatment is that of kinesitherapy, pharmacotherapy, as well as various forms of physiotherapy [7,8]. In recent years, attempts have been made to use new methods of physical medicine, added to complex therapy, including alternating magnetic fields, which demonstrate substantial treatment efficiency in case of numerous diseases of central and peripheral nervous system [9,10].

In 2007 a new form of treatment with use of variable magnetic field, so called spatial magnetic field, war introduced into clinical practice by Sieroń A. et al. [11]. The beneficial effect of this method on the regeneration of the crushed rat sciatic nerves was confirmed in experimental study [12].

The spatial magnetic field is generated in the system of three pairs of spatially oriented field applicators, coupled with each other (so-called magnetic coils), whose plains are arranged at 90º one to another. Applicators of spatial gradient magnetic field are located along the coordinate axis of three dimensional Cartesian space, to obtain the distribution of spatial magnetic field, which is required for therapeutic reasons. Magnetic field applicators enable to obtain a uniform field with a uniform field with possibly great concentration (oscillatory, rotational field) – simultaneously in time and three-dimensional space, which assures a very precise location of the sequence of magnetic impulses. The generator produces energy on the basis of four components: constant, sinusoidal, linear, and trapezoidal ones, which may be summed arbitrarily, also their fundamental frequency may be changed. The same value is assumed for each component (about 0-40 Hz). The shape of the current generated in three channels is the same. The system comprises the following devices and functional blocks:

Control Block, Execution Block, Applicator Block, consisting of 3 pairs of magnetic field applicators, Power Supply Block and digital osciloscope.

The system is provided with a special PCI card with a digital signal processor and systems of analog-digital interface, controlling the power electronics converters. Operation of the console, connected with inputting parameters of therapeutic cycle is based on an autonomous programme, functioning in WINDOWS XP environment, installed on the host computer [11,13].

Magnetic field therapy has well-known effects in enhancing enzymatic activity, oxy-reductive processes and better blood circulation, what results in better oxygenation and conduction characteristics of regenerating peripheral nerves. These mechanisms base on the influence of magnetic field on liquid-crystal structure of many membranes and cell organelles resulting in ion-channels transmission changes. Alteration in intra- or extracellular ion distribution leads to changes in electric potentials in organelle membranes as well as in cellular membranes of living biological systems. It is proved that electromagnetic field alters/influences cell proliferation, ion transport, enzymes activation and protein concentration [12].

The aim of the study has been to present the results of treatment with use of spatial magnetic field applied to two patients after trauma-induced upper limb injury, with subsequent paralysis of the median nerve.

Case Report

51-year-old patient (S.E./2011) has been admitted to Department of Internal Medicine, Angiology and

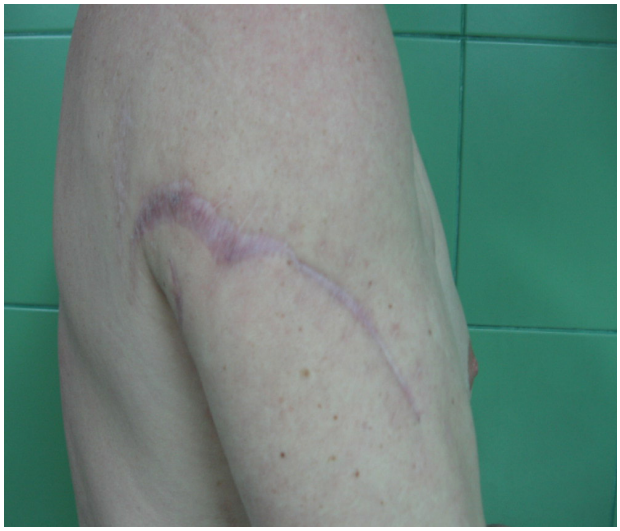

Figure 1. The local state before the spatial magnetic fields therapy.

Physical Medicine in Bytom of medical University of Silesia in Katowice because of trauma-induced damage to the upper limb (cut with window pane). The trauma resulted in a penetrating slicing wound of the medial region of the right arm and shoulder, with injury of the dicephalous nerve, and tricephalic median nerve, as well as right brachial artery (Figure 1).

Before the therapy was started in the Clinic, electromyography (EMG) had been performed, with the following results: "*Right median nerve not excitable, demonstrating features of complete denervation, no signs of reinnervation were detected*".

Motor disturbances in that patient concerned a substantial degree of muscular weakness in the limb affected (score of 2 in Lovett's scale), forearm pronation weakening, finger flexion practically impossible, fist formation impossible, slight flexion of fingers IV and V. No thumb movement could be performed, contracture in elbow joint.

31-year-old patient (K.M./2011) was admitted to the same Clinic, due to trauma-induced injury of right upper limb, with subsequent median nerve paralysis (Figure 2). As indicated in the medical documentation, trauma was the cause of nerve damage (nerve cut by foodstuff packaging machine). The patient underwent a surgical procedure, subsequently the limb was put in plaster cast (for 1 month). Suitable pharmacotherapy was applied, without satisfactory results.

Figure 2. The local state before the spatial magnetic fields therapy.

Before treatment, the physical revealed muscular weakness in the palm area (weakened grip strength), forced limb position manifesting in wrist drop, diminished sensory potential in the affected nerve, as well as reduced range of involuntary movement of forearm and palm/wrist. The limb was hanging as if paralysed the trunk in adduction.

Before the therapy was started in the Clinic, electromyography (EMG) had been performed, with the following results: "*Blocked conduction of left median nerve, at stimulation of motor fibres, together with incomplete break of axon, and preserved continuity of neurolemmas of that nerve*".

In the course of therapy, provided in outpatient mode, the patients were subjected to 45-day cycle of procedures, using a generator for therapy with spatial magnetic field (Figure 3).

Figure 3. The apparatus to application of spatial magnetic fields, Poland.

Patients underwent procedures 2 times a day in three, 3-week cycles, comprising 15 procedures (weekdays only, excluding Saturdays and Sundays), with a 4-week break before each therapeutic session. The following physical parameters of magnetic field have been used: course of magnetic field impulse – (procedure 1 – triangular course, procedure 2 – sinusoidal course, frequency – 40 Hz and magnetic induction – 30 mT), time of each procedure - 15 minutes.

Discussion

The follow-up EMG in the 51-year-old patient revealed: "*In the right median nerve, responses of sensory and motor conduction have been registered. The nerve clearly demonstrates reinnervation features*". Moreover, improvement has been achieved as regards manual skills of the palm. The therapy contributed also to substantial improvement and increase of muscular power, not only in the arm, forearm, but also in the palm (score of 4 in Lovett's scale).

The follow-up EMG in the 31-year-old patient revealed: "*Conduction parameters in sensory and motor fibres of the median nerve on the right side within norm*". After the therapy had been completed, improved muscle force was noted, as well as extended range of involuntary movement of the right upper limb, which had been impaired before

The warrant for therapeutic action of magnetic fields in case of peripheral nerve damage is the stimulation of reparation and regeneration processes in nerve tissue

[10,14]. Intensification of those processes leads to speeding up the recurrence of regular structure and functions of axons in the damaged nerves, better blood supply to nerves [3,15]. Moreover, magnetic field improves nerve tissue metabolism. That is related to intensified utilization of oxygen at cell level, resulting from increased diffusion and oxygen uptake by cytochrome, which promotes stimulation of ATP synthesis in oxidation. Additionally, it modifies the speed of impulses in nerve fibres. That mechanism is connected with influencing the structure and function of membrane calcium channels in neurons, as well as distribution of sodium, potassium and calcium ions in extracellular and intracellular spaces) [3,10].

In the case of nerves damage introduce a different physical methods and kinesitherapy exercises. One of them are magnetic fields procedures. Magnetic fields are very profitable methods because they are then non - invasive, painless and non palpable methods. It additionally, what important is, even after the execution of surgical procedures these methods can in case after intervention directly introduce. It was not one should take off dressings, or detachable linings, and this is the more important because on acceleration the regeneration of nerves it has their warming up influence.

In actual study a significant therapeutic effect of spatial magnetic field in the treatment of median nerve paralysis was confirmed resulting in both improvement of clinical status and improvement of the nerve conduction parameters in EMG. The weakness of the study is related to its casuistic character, as it presents the results of treatment of only two patients.

In order to confirm the therapeutic efficacy of the analysed method it is necessary to perform in the future a randomised, double-blind clinical trial with use of more numerous group of patients and a control group, in which sham-exposure will be performed.

Conclusions

Spatial magnetic field allows to obtain beneficial therapeutic results in the treatment of trauma-related lesions of the median nerve.

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