A NOVEL APPROACH TO THE REHABILITATION OF PATIENTS AFTER SURGICAL TREATMENT OF INTERVERTEBRAL DISC HERNIATION

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Abstract: *This article presents the results of a clinical study aimed at improving the effectiveness of rehabilitation in patients following surgical treatment of lumbar intervertebral disc herniation. A total of 52 patients were examined and divided into a study group (n = 27) and a control group (n = 25); all patients received standard therapy (NSAIDs, kinesiotherapy, hydrokinesiotherapy), while patients in the study group additionally underwent a course of general magnetotherapy (UMTI-3F "Kolibri-Expert" device, 8–10 sessions, magnetic induction 1–3.5 mT). Outcomes were assessed using the VAS pain scale, the SAN questionnaire, the Oswestry Disability Index, and infrared thermography. The study established that adding general magnetotherapy to the rehabilitation program provided a significantly more pronounced regression of pain syndrome (complete resolution in 51.9% of cases versus 28% in the control group), accelerated the normalization of local hemodynamics in the surgical area, and reduced the degree of functional disability, confirming the feasibility of this approach in early postoperative rehabilitation.*

Keywords: *discectomy; intervertebral disc herniation; general magnetotherapy; rehabilitation; lumbar spine.*

Introduction Degenerative-dystrophic diseases of the spine are among the most common pathologies of the musculoskeletal system and represent a serious medical and social problem due to their high prevalence, prolonged periods of temporary disability, and a significant risk of disability in patients of working age [1]. According to epidemiological studies, signs of intervertebral disc (IVD) degeneration are detected in approximately 20% of adolescents, while in patients over 70 years of age, more than 60% of IVDs exhibit morphological signs of severe degeneration [2].

In the pathogenesis of the degenerative process, most researchers identify three successive phases that differ in the severity of their morphological and biochemical changes [3–5]. The first phase is characterized by dehydration of the nucleus pulposus and the formation of fissures in the annulus fibrosus, which creates the preconditions for herniation. During this period, the disc loses its shock-absorbing properties and becomes vulnerable to mechanical stress. The second, intermediate phase is caused by the increasing extrusion of degenerated fragments of the nucleus pulposus: as its volume decreases, the load on the annulus fibrosus increases, leading to the development of a protrusion and then a disc herniation, accompanied by a reduction in the height of the intervertebral space. In the third and final phase, destruction of the annulus fibrosus and nucleus pulposus occurs with progressing fibrosis of the disc tissue; against the backdrop of vertebral motor segment hypermobility, spondyloarthrosis and osteophytes form as a compensatory reaction of the body.

The most clinically significant manifestation of the degenerative process is a herniated intervertebral disc (HID): in more than 80% of cases, it is localized in the lumbar spine. Compression of the nerve roots and radiculomedullary vessels causes the development of arterial and venous ischemic disorders, paresis and paralysis of the lower limb muscles, as well as pelvic organ dysfunction [6].

Modern approaches to the surgical treatment of herniated intervertebral discs are focused on minimizing intraoperative trauma and maximizing the improvement of patients' quality of life.

However, even when technically successful, surgical intervention only eliminates the mechanical compression factor, without addressing neurodystrophic changes or eliminating the risk of recurrence [7]. Intraoperative mechanical impact on neurovascular structures inevitably leads to the impaired functional state of the segmental nerve bundles and microcirculation of the spinal motion segment. In the early postoperative period, a significant portion of patients continue to experience sensory disturbances, incomplete recovery of motor functions, and psycho-emotional disorders. In 10–12% of cases, a pronounced cicatricial-adhesive process develops, which disrupts local hemodynamics (primarily the venous component), causing nerve root edema and persistent pain syndrome [8].

Postoperative drug therapy—including non-steroidal anti-inflammatory drugs, glucocorticoids, non-narcotic analgesics, antispasmodics, and dehydration agents—is aimed at relieving pain and preventing the formation of adhesions, but its effectiveness is insufficient for a patient's full recovery [10]. This underscores the need for early comprehensive rehabilitation that mandatorily includes physical therapy methods [8, 9].

In the current practice of physiotherapeutic management of patients after surgical treatment of HNP, a syndromic approach prevails: pronounced pain syndrome is treated with pulsed currents (diadynamic, sinusoidally modulated, fluctuating), ultrasound therapy, and low-intensity laser therapy combined with low-frequency magnetotherapy; sensory disorders are corrected with transcutaneous electrical stimulation; and motor disorders are treated with pulsed magnetotherapy [11, 12]. However, all these methods have a predominantly local effect and do not address systemic hemodynamic and astheno-neurotic disorders.

In this context, general magnetotherapy (GMT) is of particular interest. This method involves applying a low-induction magnetic field (1–3.5 mT) to the patient's entire body using a large-diameter solenoid. The systemic nature of this exposure makes it possible to simultaneously affect the body's key functional systems, activate redox processes, and improve various types of metabolism [13, 14]. The therapeutic effects of GMT include anti-inflammatory, reparative, immunomodulatory, antioxidant, and sedative actions, as well as the normalization of systemic microcirculation in vascular and vertebrogenic diseases [15–18]. During treatment, venous, arterial, and capillary insufficiencies are corrected: perivascular tissue edema is reduced, the microcirculatory bed is opened, and tissue hypoxia is resolved, which clinically manifests as a regression of pathological symptoms caused by vascular disorders.

The data presented above served as the basis for the present study, the objective of which was to evaluate the effectiveness of including GMT in a comprehensive rehabilitation program for patients after surgical treatment of herniated discs in the lumbosacral spine.

Materials and Methods.

A prospective controlled study was conducted at the Perfect Diagnostic Clinic in Samarkand, Uzbekistan. The study included 52 patients in the early recovery period following various types of surgical treatment for herniated intervertebral discs of the lumbosacral spine. All participants were monitored and received treatment exclusively at this institution.

Inclusion criteria were: a verified diagnosis of a herniated intervertebral disc of the lumbosacral spine, having undergone elective surgery, being in the early postoperative period (no more than 4 weeks after surgery), and having provided signed informed consent. Exclusion criteria were: an implanted pacemaker, decompensated cardiovascular diseases, cardiac arrhythmias, acute infectious diseases, and pregnancy.

Using simple randomization, the patients were divided into two groups comparable in age, sex, and the extent of the surgery performed. The control group (n=25) received standard therapy, which included nonsteroidal anti-inflammatory drugs, glucocorticoids, non-narcotic analgesics, antispasmodics, kinesitherapy, and hydrokinesitherapy. In addition to the standard therapy, patients in the main group (n=27) received a course of OMT.

The UMTI-3F "Kolibri-Expert" apparatus was used to perform OMT procedures. The procedures were performed in a gradually increasing intensity mode: the magnetic induction was sequentially increased from 10% to 60% of the maximum value (3.5 mT). The course consisted of 8–10 daily sessions, each lasting 15–20 minutes. The procedures were conducted in the morning in a specially equipped physiotherapy room at the clinic.

Patient condition was assessed twice—before and after completion of the treatment course—and included: a neurological examination to determine the status of sensory and motor impairments; remote infrared thermography of the back and lower extremities using the IRTIS 2000-ME thermograph for an objective assessment of local hemodynamics in the surgical area; assessment of pain using a 10-point visual analog scale (VAS); assessment of well-being, activity, and mood using the WAM (SAN) scale; and assessment of the degree of disability using the Oswestry Disability Index (version 2.1a).

Statistical analysis of the data was performed using standard methods of parametric and non-parametric statistics. Differences were considered statistically significant at $p < 0.05$.

Results and Discussion.

At the initial examination, all patients in both groups presented with a similar clinical profile characteristic of the early postoperative period. Constant moderate pain in the lumbar region radiating to the lower extremities was noted in 100% of cases; restricted mobility of the lumbar spine in 94.2% of patients; sensory disturbances in 75.0%; a depressed emotional state in 69.2%; and increased fatigue in 90.4%. Nerve root tension signs were detected in 92.3% of cases. The differences between the groups for all baseline indicators were statistically insignificant ($p > 0.05$), which confirms the comparability of the groups.

After completion of the rehabilitation course, positive changes were observed in patients of both groups, but the extent of these changes differed significantly. In the main group, complete pain relief was achieved in 51.9% of patients, and partial reduction in 48.1%. In the control group, the corresponding figures were 28.0% and 72.0%, respectively. Thus, the rate of complete pain regression in the main group was 1.85 times higher than in the control group, indicating a significant potentiation of the analgesic effect when OMT was included in the rehabilitation program.

The regression of nerve root tension signs in the main group occurred on average 3.2 ± 0.4 days earlier than in the control group, reflecting a more rapid reduction in radicular irritation and perineural edema under the influence of systemic magnetic therapy.

Analysis of the SAN scale data revealed an improvement in the well-being, activity, and mood scores in both groups. However, in the main group, the increase across a number of subscales was significantly higher ($p < 0.05$), which indicates an additional neurovegetative and sedative effect of OMT that promotes the correction of astheno-neurotic disorders in the postoperative period.

The results of the Oswestry Disability Index are particularly noteworthy. A significant decrease in the disability index was recorded in the main group ($p < 0.05$), whereas in the control group, the changes in this indicator did not reach statistical significance. This suggests that OMT not only reduces pain but also improves the patient's functional status in daily life—a parameter of fundamental importance from the perspective of social and occupational rehabilitation.

Objective verification of the clinical results was performed using infrared thermography. At baseline, patients in both groups exhibited pathological hyperthermia in the surgical site, reflecting a local hemodynamic disturbance. After the course of treatment, the mean temperature decrease in the study area was 1.48 ± 0.09 °C in the main group, whereas in the control group this indicator reached only 0.76 ± 0.05 °C ($p < 0.05$). Normalization of the local temperature gradient indicates an improvement in microcirculation and venous outflow in the surgical area, which is consistent with the known mechanisms of OMT's effect on the vascular component of hemodynamics.

The results, taken together, confirm that incorporating general magnetotherapy into a comprehensive rehabilitation program for patients after surgical treatment of herniated discs of the

lumbosacral spine significantly increases its effectiveness. The systemic nature of general magnetotherapy allows for the simultaneous treatment of pain syndrome, microcirculatory disorders, neurovegetative imbalance, and the patient's functional status—unlike local physiotherapy methods, which have a limited spectrum of action. The practical implementation of this method in a multidisciplinary clinic does not require special infrastructure and is well-tolerated by patients. All this substantiates the expediency of widely incorporating general magnetotherapy into the standards of postoperative rehabilitation for this category of patients, and also outlines prospects for further research on optimizing the parameters of magnetic exposure and developing differentiated treatment protocols.

Conclusions.

A clinical study conducted at the Perfect Diagnostic Clinic (Samarkand, Uzbekistan) demonstrated the high therapeutic efficacy of including general magnetotherapy in a comprehensive program for the early rehabilitation of patients after surgical treatment of herniated discs of the lumbosacral spine.

1. General magnetotherapy is an effective and safe method of physical rehabilitation for patients in the early postoperative period after a discectomy, possessing a systemic, multilevel effect.
2. Including general magnetotherapy in a rehabilitation program statistically significantly increases treatment effectiveness compared to standard therapy alone, shortens the time to pain relief, and accelerates the normalization of local hemodynamics.
3. The method is well-tolerated by patients, does not require complex infrastructure, and can be successfully implemented in a multidisciplinary clinic setting.
4. The results obtained justify the inclusion of general magnetotherapy in the standards for postoperative rehabilitation of patients with herniated intervertebral discs of the lumbosacral spine.

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