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(CASE REPORT)

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Case report: Association of laser and magnetotherapy with iPRF for treatment of herniated disc

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Abstract

Lumbar disc herniation is one of the main causes of pain and disability, affecting 1% to 5% of the adult population, especially between 30 and 50 years of age. Conservative treatments include corticosteroids, anti-inflammatories, and physical therapy, with surgery being reserved for refractory cases. Surgical complications are possible, including pain and neurological sequelae. This study presents the clinical case of an extrusive disc herniation in a 49-year-old patient, treated with orthobiologicals (iPRF), superpulsed laser and pulsed magnetic field, resulting in symptom improvement and total remission of the hernial process confirmed by Magnetic Resonance Imaging. The association between a minimally invasive approach proved to be effective, suggesting the feasibility of using combined therapies to treat disc herniations with remarkable clinical improvement in two months, without surgical risks and hospital costs. The synergy between iPRF, superpulsed laser, and pulsed magnetotherapy promotes cell recovery and inflammatory modulation.

Keywords: Disc hernia; Minimally invasive treatment; Regenerative medicine; Orthobiological; iPRF; Superpulsed laser; Pulsed magnetic field

1. Introduction

Herniated discs are an important cause of low back pain, a pain condition that causes several deficits in the lives of patients, in addition to the direct impact on work capacity, being a significant cause of absenteeism [1, 2, 3]. Lumbar disc herniation is a frequent condition that affects the spine, resulting in inflammation or compression of adjacent nerves and causing severe pain. The prevalence of this condition varies between 1% and 5% of the population, being the main cause of spine surgery in the adult population [3, 4, 5].

Lumbar disc herniation predominantly occurs between the fourth and fifth decades of life, affecting an average age group of 37 years, but it can occur in other age groups, from children to the elderly [5, 6]. In addition to affecting the most varied age groups, it is the most common degenerative alteration in the spine, in addition to being one of the main causes of temporary absence from work, resulting in significant lost workdays for workers who are possibly at the peak

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of their professional capacity. [3, 7] The prevalence of back pain in the United States resulted in 4.6% of lost workdays [1]

Risk factors for disc herniation include ergonomic causes, such as poor postures and repetitive physical exertion, as well as genetic and metabolic factors [4, 5, 6]. The typical clinical picture includes initial low back pain, followed by low back pain, and finally pure sciatica. [3, 4]

Statistically, most cases of disc herniation occur at the lumbar level, especially between L4-L5 and L5-S1, and the symptoms presented include low back pain, sciatica, strength deficit and paresthesia in the L5 and S1 dermatomes, symptoms felt by patients in the gluteal region, lateral and posterior aspect of the leg, ankle and lateral part of the foot [3, 7]. It can also occur at the cervical and thoracic levels, with associated symptoms such as neck, arm, and chest pain, affecting dermatomes C6, C7, T1, and T2, corresponding to the upper arm, forearm, and hand areas. [5]

On physical examination, tests such as the Lasegue test, which involves lifting the patient's extended leg while observing the presence of pain or discomfort in the lower back or leg, and the Valsalva test, where the patient is asked to exhale strongly while lying down, observing the intensification of pain. The diagnosis is made based on clinical suspicion and confirmed by imaging tests, such as computed tomography (CT) and magnetic resonance imaging (MRI). [3]

We present a case of extrusive disc herniation, caudally migrated with an exuberant clinical picture, where we highlight the symptoms presented by the patient, the imaging exams used for diagnosis, staging, therapeutic planning, treatment instituted, clinical and imaging evolution presented by the patient, with the objective of demonstrating the clinical feasibility of the association between the application of injectable platelet-rich fibrin (iPRF) with the use of pulsed magnetic field and laser superpulsed in the treatment of disc herniation.

2. Material and methods

A 49-year-old patient, BMI: 33.7, with a history of severe low back pain, with the first crisis that occurred about 3 years ago, treated with NSAIDs, pulse therapy with corticosteroids and physical therapy, has been evolving with more intense crises and with an increasingly shorter interval between crises. On July 18, 2024, she presented pain intensification with strong radiation to the left lower limb, and that, despite having undergone drug treatment with NSAIDs, corticosteroid therapy, benfotiamine, and physical therapy treatment, she did not improve her pain. She has systemic arterial hypertension and prediabetes of antecedents. The patient evolved with an increase in the pain crisis, which took her away from her work activities as a teacher, leaving her dependent on family members to perform daily activities and personal hygiene.

She was admitted on October 4, 2024, for evaluation complaining of severe pain (VAS 10) in the lumbar spine radiating to the hip and left leg associated with strength deficit in the left lower limb (MRC grade 2). She did not present alterations in sphincter control.

On physical examination, the lumbar muscles were contracted with rectification of the lumbar lordotic axis and exacerbation of the pain on palpation of the lumbar spine in the topography of L5-S1, in addition to sensory, vibratory, thermal and pain deficits on the lateral face of the left leg, positive Lasegue and Valsalva tests. The patient had previous MRI of the lumbosacral spine, which showed extruded and caudally migrated disc herniation, generating an important mass effect in the medullary canal and root conflict at the L5-S1 level.

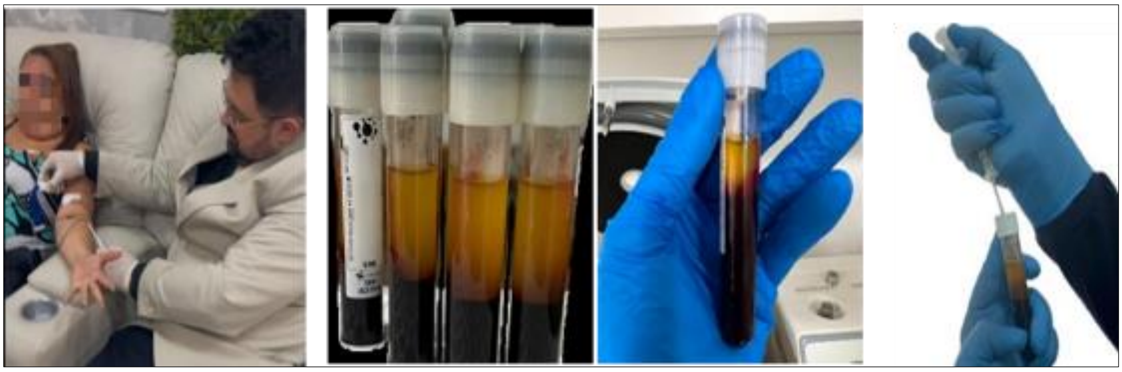

Figure 1 Collection of the iPRF

After diagnostic clarification, the patient's desire not to undergo a surgical procedure and her desire to try to perform minimally invasive interventional treatment were expressed. An Informed Consent Form was provided for the use of autologous orthobiological products and laser therapy and magnetic field, as well as for the use of the data for research purposes. We opted for the association between an application of the autologous biological product iPRF facet at the affected level and by caudal epidural route associated with 8 sessions of superpulsed laser and the pulsed magnetic field around the herniated disc, which were performed 2 times a week.

The intervention was carried out on October 11, 2024 with the preparation of 25 ml of total solution, which contains 16.5 ml of iPRF (processed from the collection of 72 ml of peripheral blood in vacuum tubes and without additives centrifuged for 5 minutes at 80g) associated with 2.5 ml of 50% glucose (total solution with 5% glucose concentration), N-acetylcysteine (3ml) and Procaine 2% (3ml). From this total solution, 20 ml was applied via the caudal epidural and 5 ml on the L5-S1 facet.

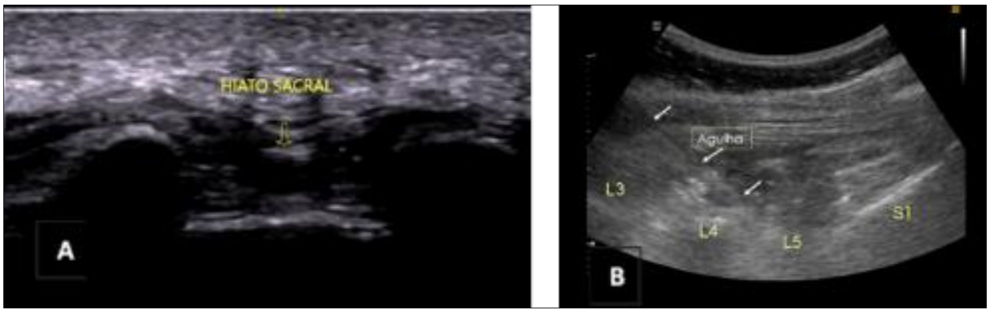

Figure 2 Sonovisualization to perform the minimally invasive procedure with the best possible accuracy. In A we have the visualization of the sacral hiatus for caudal epidural block and in B we have the visualization of the facets for selective facet block. The needle is not visualized very well in the image due to the angle between it and the ultrasound beam. However, in real time it is very identified during movement. After infiltration, the application of superpulsed laser was immediately implemented (Multi Radiance Medical Laser Shower was used with the tissue repair protocol on the hernia, associated with the muscle spasm protocol on the transverse spinatus group, which includes the rotator, interspinatus, intertransverse, semispinatus and multifidus muscles, in addition to the muscles: erector spinae and quadratus lumborum. Analgesic protocol is also performed on the sciatic nerve)

Figure 3 Application of the superpulsed laser according to the protocol described. Laser was applied to the topography of the facets (A) and sacral hiatus (C) using the tissue repair protocol (B) and to the paravertebral muscles using the muscle relaxation protocol (D)

In association with the laser, sessions were performed with a low-intensity pulsed magnetic field (the BTL-4000 Premium magnetotherapy device was used, lumbosacral syndrome protocol and trophic improvement for 30 minutes each protocol).

After infiltration in the spine, the patient underwent 2 sessions per week of laser therapy and pulsed magnetic field, evolving with an improvement of about 40% in pain after the application and a reduction of about 20% in residual pain after each week, with a 100% improvement in symptoms in the sixth session of laser associated with magnetotherapy. At this time, the patient no longer presented complaints or alterations in the physical examination, and a repeat imaging exam (magnetic resonance imaging) was suggested to evaluate the evolution of the hernia.

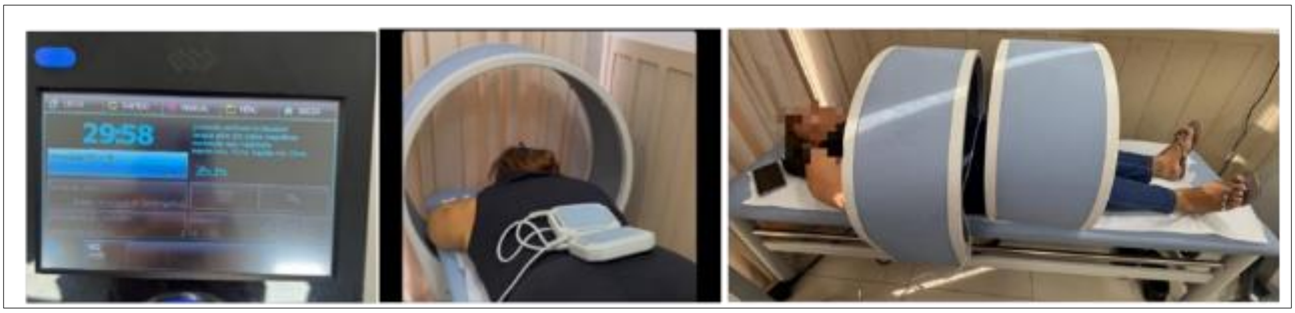

Figure 4 Application of the pulsed magnetic field in the lumbar spine

After performing a new imaging exam on December 17, 2024, we observed total regression of the hernial process at the L5-S1 level.

Figure 5 On T2-weighted axial section: extensive disc herniation with obliteration of the medullary canal and compression of the neural root at L5-S1 is observed. Sagittal section of Nuclear Magnetic Resonance Imaging, pre-treatment of the patient showing a voluminous disc herniation at the level of L5-S1 and generating an important mass effect, stenosing the spinal canal. Nuclear Magnetic Resonance Imaging sections, after the patient's treatment, where we observed regression of the hernial process, without further stenosis of the canal or compression of the nerve roots

3. Results and discussion

Herniated discs, especially lumbar ones, are a significant cause of pain and disability, affecting a considerable portion of the population. The report highlights the high prevalence of this condition and its impact on work absenteeism, emphasizing that disc herniation is one of the main causes of absence from work. [7, 8]

Traditional treatment techniques are presented by the dichotomy between conservative treatment and surgical treatment, with conservative treatment being the first choice, except for cases with persistent symptoms for more than six to eight weeks, progression of symptoms, or significant neurological damage [3, 9, 10]. Surgical treatment is reserved for cases in which there is no improvement in symptoms with conservative treatment, loss of sphincter control, cauda equina syndrome, and progressive neurological deficit. [3, 10]

Conservative treatment includes pulse therapy with corticosteroids, which consists of administering high doses of corticosteroids intravenously over a short period, usually three to five days [3]. In addition, the use of non-steroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen and diclofenac, is common to relieve pain and inflammation [3, 5], but studies question the use of these medications due to the risk of these drugs impeding the pathophysiological process of spontaneous resorption of disc herniation. [11]

Analgesics, such as paracetamol and dipyrone, are often prescribed to relieve moderate pain, and in cases of severe pain, opioids are frequently used [3]. Physiotherapy rehabilitation is also essential, including therapeutic exercises, mobilization techniques, and postural reeducation. [4, 7]

Within the spectrum of surgical treatment, we have the option of a conventional approach, minimally invasive treatment with the use of a microscope and an arthroscopic approach. [3, 5]

Surgical treatment is not without complications, with cases of infections, hemorrhages, deep vein thrombosis, [2,12]. Other specific complications may include postoperative pain, generating the need for new interventions, and neurological sequelae resulting from the surgical procedure [11].

Although conventional conservative treatment is the first choice and surgical treatment is reserved for cases of persistent symptoms, [10] it is necessary that new treatments be developed to relieve pain and restore the work capacity of patients whose conservative treatment has not obtained results and who cannot or choose not to undergo surgical treatment. And in the space between these two treatment options, we gradually observe the exponential growth of minimally invasive techniques for pain control and regenerative approaches. [13]

Spinal infiltrations are minimally invasive procedures that involve injecting medications directly into the site of pain, using image guidance such as fluoroscopy or ultrasound to ensure the accuracy of the injection. This method is effective in reducing inflammation and relieving pain, providing a less invasive alternative to surgical treatment [5, 14]. The precision and efficacy of infiltrations are particularly useful in patients who do not respond well to conservative treatments.

Selective facet block is a technique that aims to relieve pain by injecting drugs into the facet joint, which is one of the main sources of pain in herniated discs. This procedure helps to reduce inflammation and improve mobility, facilitating the patient's recovery. The selective application of the block allows the treatment to be targeted precisely to the affected area, increasing effectiveness and minimizing side effects.

Caudal epidural block involves injecting drugs into the epidural space through the sacral hiatus. This method is used to provide pain relief in lumbar and sacral dermatomes and is an effective option for patients with lumbar disc herniation. The caudal technique allows for a wide distribution of the drug, which is beneficial in cases of radiating pain or having multiple affected areas. [15]

Orthobiologics, such as PRP, have been used in the treatment of herniated discs due to their ability to promote tissue regeneration and healing. [16, 17, 18] Studies have shown that the application of orthobiologics can improve disc stability and reduce pain, providing an effective conservative approach to treating these conditions. PRP contains growth factors that aid in the repair of damaged tissues, accelerates recovery, and reduces patient downtime. [16, 17]

On the other hand, injectable platelet-rich fibrin (iPRF), an orthobiological obtained from a closed-system centrifugation, releases factors such as PDGF, TGF-β, and VEGF, which are essential for tissue regeneration and healing.

The presence of these growth factors in a biological matrix stimulates cell proliferation and extracellular matrix synthesis, contributing to the repair of damaged disc structures [19]

PRP could release a large volume of growth factors, but this stimulus is fleeting, unlike iPRF, which can maintain the stimulus with growth factors for a period of up to three weeks, enough time for the necessary tissue repair. [18, 20]

In addition, recent studies indicate that the combination of iPRF with other therapies can enhance clinical outcomes [16] and laser and magnetotherapy treatments have also been explored in the management of herniated discs.

There are different types of laser emission, including continuous, pulsed, and superpulsed, each with specific characteristics and applications. The continuous emission laser provides a constant beam of light, useful in procedures that require continuous precision. The pulsed laser emits light in regular pulses, allowing for a more controlled application of the energy. The superpulsed laser, on the other hand, combines the benefits of continuous and pulsed modes, emitting high-intensity pulses at extremely short intervals, which allows a high concentration of energy without a significant increase in temperature in the tissues. [21, 22]

The superpulsed emission mode is especially effective for regenerative medicine due to its ability to promote photobiomodulation without photothermal effect and with a lower risk of tissue damage [23]. This type of laser facilitates tissue regeneration, as the short, intense pulses stimulate ATP production and collagen synthesis, as well as reduce inflammation and pain. By minimizing temperature rise, the superpulsed laser prevents tissue necrosis and other unwanted side effects, making it a safe and effective choice for regenerative treatments. [24, 25]

The simultaneous use of different laser wavelengths, such as 670nm, 875nm and 905nm, has been investigated as a strategy to maximize the regenerative biological response. The 670nm wavelength is effective in promoting photobiomodulation and reducing inflammation in lesions [26, 27]. The 875nm wavelength is known for its deeper penetration capacity, stimulating tissue regeneration in deeper layers [28]. Finally, the 905nm wavelength is highly effective in reducing pain and accelerating the healing process, due to its high penetration and efficiency in tissue stimulation [29]. The combination of these wavelengths enhances the activity of Cytochrome C Oxidase, promoting a cellular response and inducing tissue repair [30] while the association of these three wavelengths increases the laser's ability to penetrate biological tissue. [31]

The pulsed magnetic field (CMP) has been widely used in the treatment of lumbosciatic pain secondary to lumbar disc herniations due to its ability to promote blood circulation and reduce pain and inflammation [32, 33, 34, 35, 36]. Clinical studies demonstrate that the application of CMP can relieve pain and improve motor function in patients with lumbar disc herniation, providing an effective and non-invasive alternative to conventional treatment [32, 35, 37, 38]. CMP acts by inducing electrical currents in tissues, stimulating the production of growth factors and improving cell regeneration. [34, 39]

The physicochemical mechanisms involved in the therapeutic effect of CMP include modulation of gene expression and activation of cell signaling pathways [34, 39]. Exposure to the pulsed magnetic field can increase the production of growth factors such as platelet-derived growth factor (PDGF) and transforming growth factor beta (TGF-β), which are essential for tissue repair and regeneration of intervertebral discs. In addition, CMP can reduce the expression of pro-inflammatory cytokines, such as tumor necrosis factor alpha (TNF-α), contributing to the reduction of inflammation and pain. [37, 38]

The efficacy of CMP in the treatment of lumbosacral pain secondary to lumbar disc herniations has been demonstrated in several clinical studies. For example, randomized controlled trials have shown that patients treated with CMP had a significant reduction in pain intensity and functional disability compared to the control group [32, 37, 40]. Another study noted that combining CMP with physical therapy resulted in improved clinical outcomes, including improved mobility and quality of life for patients. [41]

In summary, the pulsed magnetic field is a promising therapy for the treatment of lumbosacral pain secondary to lumbar disc herniations, offering an effective and safe approach to relieve pain and promote tissue regeneration [38, 42, 43]. The application of CMP can activate physicochemical mechanisms that favor the production of growth factors and the reduction of inflammation, contributing to the recovery of patients. [44, 45]

By knowing the mechanism of action of the three therapies, it is possible to understand how they act on the improvement of pain in patients: the symptoms presented in these cases do not result only from the pure mechanical compression caused by the hernia, it can result from a significant inflammatory reaction when the nucleus pulposus, with immunogenic potential, herniates, with the release of important inflammatory mediators such as PLA2 and TNF. Sciatica is thought to be caused by a combination of mechanical compression and biological inflammation. [12, 14]

The combination of treatments with injectable platelet-rich fibrin (iPRF), superpulsed laser, and pulsed magnetotherapy in the treatment of herniated discs presents several synergism pathways that enhance the recovery of patients.

The application of superpulsed laser, through photobiomodulation, acts at the molecular level promoting cell proliferation and differentiation. This process involves the activation of metabolic pathways that increase ATP production in mitochondria, improving cellular functionality and accelerating the recovery of affected tissues. [2, 28, 46, 47]

In turn, pulsed magnetotherapy plays a crucial role in inflammatory modulation. Exposure to pulsed magnetic fields reduces the release of inflammatory mediators and improves local blood circulation, which decreases edema and pain[45]. This inflammatory response modulation effect is essential for the efficient recovery of patients, as it reduces the chronic inflammation that often accompanies herniated discs. [44, 48, 49]

The efficacy of these therapies alone has been demonstrated in several studies, which have reported significant pain reduction and functional improvement in patients treated with these therapeutic modalities [2, 37]. In addition, the synergy between superpulsed laser and magnetotherapy involves mechanisms such as reducing inflammation, stimulating tissue regeneration, and improving blood circulation.

Therefore, the combination of iPRF, superpulsed laser, and pulsed magnetotherapy results in a synergistic approach, where each treatment complements the other. The iPRF promotes tissue regeneration, the superpulsed laser accelerates cell recovery, and magnetotherapy controls the inflammatory response, facilitating healing and improving disc functionality.

Thus, the integration of these treatments is capable of inducing disc herniation remission, emerging as a conservative therapeutic option for patients with disc herniations, promoting recovery and quality of life.

4. Conclusion

The clinical case illustrates the feasibility and efficacy of a minimally invasive treatment using the combination of orthobiologicals (iPRF), superpulsed laser, and pulsed magnetic field to induce remission of an extruded and caudally migrated disc herniation.

The application of iPRF promotes the release of growth factors and activation of stem cells, while the superpulsed laser and the pulsed magnetic field help to reduce inflammation and promote healing, leading the patient to present total improvement of the symptoms and complete remission of the hernial process, evidenced by imaging without the costs inherent to the surgical procedure and being able to return to her work activities within two months with imaging follow-up by magnetic resonance imaging performed after 67 days, showing total regression of the disc herniation. And the patient did not have any side effects.

The combination of these approaches has the potential to revolutionize the treatment of herniated discs, offers a safe, low cost and effective alternative for patients who do not respond adequately to conservative treatment and are unwilling or unable to undergo surgical treatment.

Although more studies are needed, with a larger sample to statistically evaluate the method, this technique may revolutionize the treatment of herniated discs, reducing the costs of treating this pathology and providing a significant improvement in the pain and work capacity of patients, without the risks inherent to surgical treatment.

Compliance with ethical standards

Disclosure of conflict of interest

Author Douglas Scott Johnson presents as a conflict of interest to serve as Senior Vice President of Clinical and Scientific Affairs at Multi Radiance Medical and Chief Scientific Officer at PhotoOpTx. The other authors have no conflicts of interest.

Statement of ethical approval

This case report was carried out in accordance with the principles of research ethics and in accordance with the declaration of Helsinki.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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