

## EVALUATION OF THE THERAPEUTIC EFFICACY OF COMPUTED TOMOGRAPHY- GUIDED PERIRADICULAR THERAPY IN PATIENTS WITH EXTRAFORAMINAL DISC HERNIATIONS

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### Abstract

Periradicular therapy (PRT) is a minimally invasive radiological technique for treatment of chronic lumbar pain.

The aim of this study was to investigate the efficacy of PRT in patients with chronic lumbar pain and radiculopathy due to extraforaminal disc herniation.

The study included a prospective follow-up of 30 patients with chronic lumbar pain and radiculopathy. All patients underwent magnetic resonance imaging (MRI) and extraforaminal neuro-radicular conflict was detected. The degree of pain intensity was scored according to the VAS scale. The degree of improvement was presented as excellent (over 75%), good (50 -70%), intermediate (25-49%) and poor (less than 25%). Functional and working status was rated according to Oswestry Disability index2.0 (ODI). Follow-up of treated patients was at 2 weeks and 3 months.

After 2 weeks the improvement was excellent in14 patients (47%), good in 7 patients (23%), moderate in 7 patients (23%) and mild in 2 patients (7%). Improvement after 3 months was excellent in 15 patients (50%), good in 7 patients (23%), moderate in 3 patients (10%) and poor in 5 patients (17%). The improvement of the functional status according to the ODI score was at least 40% in 73.3% of patients after 2 weeks and 86.5% of patients after the third month.

CT controlled PRT in patients with lumbar radiculopathy is a safe and effective procedure leading to a significant pain reduction and a better quality of life after the procedure.

**Keywords:** epidural, steroid, lumbar, spine, radicular

### Introduction

Chronic lumbar pain and radiculopathy is a clinical lumbar pain syndrome accompanied with limb pain involving sensory or motor deficits on the affected side for more than 12 weeks [1].

In cases where the reduction of pain is insignificant, after exhausting all traditional treatments involving oral analgesics, anti-inflammatory drugs or in cases of systemic application of the aforesaid, another choice is the minimally invasive intervention, i.e. selective periradicular infiltration at the level of the compressed nerve root.PRT is a method of treatment that includes chronic spinal pain therapy, usually due to disc herniation, disc swelling, or degenerative changes. PRT is a minimally invasive radiological technique that uses a thin needle to approach the affected nerve root and to administer a CT-monitored medication[2].

For maximum accuracy and superior anatomical orientation and minimum complications, the intervention is monitored and performed under a computed tomography scan [3].

The introduction of a cocktail consisting of an anesthetic and corticosteroid into the lateral epidural space, or around the nerve radix, leads to inhibition of inflammatory mediators, thereby reducing the degree of pain [4].

The aim of this study was to evaluate the clinical efficacy of periradicular therapy in patients with chronic lumbar pain and radiculopathy caused by extraforaminal disc herniations.

### Materials and methods

The study was conducted at PHI CGH "8 September" - Skopje in the Department of Radiology and Interventional Radiology from January 2019 to December 2019. The study was an open non-

randomized prospective study that included prospective monitoring of 30 male and female subjects with chronic lumbar and radicular pain. Subcutaneous application of 3ml Lidocaine as well as 2ml Bupivacaine and 2ml Kenalog at the level of the lateral epidural space was administered in all subjects. The application of the medicine (Bupivacaine and Kenalog) was monitored with a 16-slice computed tomography (CT).

The intensity of pain was scored according to the visual analogue scale (VAS scale) and included mild, moderate and severe pain. The degree of improvement was presented as excellent (over 75%), good (50-70%), moderate (25-49%), poor (less than 25%). The follow-up of the treated patients was at 2 weeks and at 3 months.

In this study, only the group of patients with mechanical radiculopathy, i.e. patients with extraforaminal disc herniations, were monitored.

Inclusion criteria were: radiculopathy that was not resolved by traditional treatment in a timeframe not more than 4 weeks, including treatment with analgesics, anti-inflammatory drugs, physical therapy, clinical examination suggesting lumbar radiculopathy, MR examination that verified the clear existence of extraforaminal disc herniations, with signs for mechanical radix compression according to the clinical symptoms.

Exclusion criteria were: allergies, pregnancy, and absence of indicators of radix compression on the MRI examination, as well as other pathological conditions that may give identical symptoms, anticoagulant treatment, and metabolic radiculopathy.

Prior to the PRT, all patients were examined by a neurologist, neurosurgeon, and radiologist with a clinical examination as well as an EMG (electromyography) and the decision for treatment was made based on the Medical Evaluation Advisory Board opinion. Insulin, 18 gauge and chiba needles were used in all patients.

All patients underwent laboratory tests, as well as hemostasis, and blood glucose level examinations. Prior to the PRT, all patients were treated with a full per os course of treatment with analgesics, anti-inflammatory drugs, intramuscular administration of medicine, rest and at least one physical therapy treatment.

### **PRT technique**

For achieving maximum accuracy and superior anatomical orientation and minimum complications, the procedure was performed on the CT scan. Before the start of the intervention, a detailed consultation was conducted with all patients regarding the technical part, benefits, expectations and potential complications that may occur during and after the procedure.

Patients were comfortably positioned in a prone position (chest down) in the CT scan with their hands to the side or under their head. Local marking was placed along the median line on the surface of the skin with a thin metal wire that was attached to a band-aid serving as a skin marker or anatomical landmark to make appropriate measurements, accurate to the millimetre, so as to define the puncture site. A thin 2mm cross-section was scanned, the application site was defined and the approach and angle of insertion of the needles were determined. The marker (wire) was removed. The field of work was limited and the site was completely disinfected. Local anesthesia consisting of approximately 3ml Lidocaine was applied with a thin needle, which was gently inserted subcutaneously.

The procedure continued with the introduction of an 18gauge needle that extended to the inside with the CT support and a short scan. With the help of CT monitoring the deeper layers were penetrated sequentially with an additional longer needle (chiba). The direction of the needle was distal, first in the superficial muscles, and then in the deep muscles, done with a perpendicular or lateral approach always in the parafacet and in contact with the facet joint. This ensured a good needle position, whereby the tip was positioned at the level of the lateral epidural space with a periradicular placement closest to the nerve root, slowly administering the anesthetics (3ml Bupivacaine) and then the corticosteroid (2ml Kenalog). With the removal of the needle, the intervention ended with a local dressing that was kept for 24 hours. Patients were placed in the adjacent premises and monitored around 2 hours with check-ups each 30

minutes, and afterwards by giving them some short instructions and advice when they were released and free to go home.

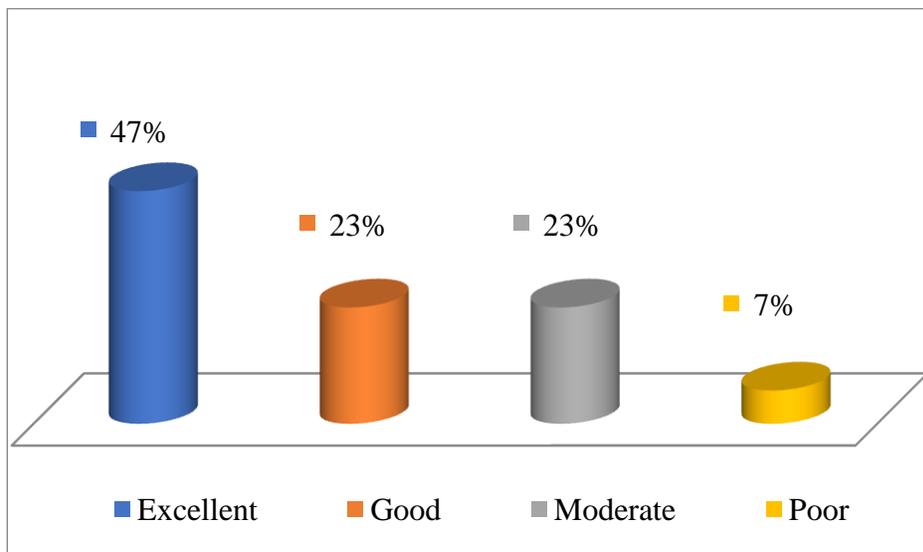
**Results**

Our study included 30 patients with chronic lumbar pain and radiculopathy aged 42-82 years. The mean age was 63 years for male patients and 62 years for female patients, of whom 14 were men (47%) and 16 women (53%) (Table 1).

**Table 1.**Number of patients by gender and age (mean age)

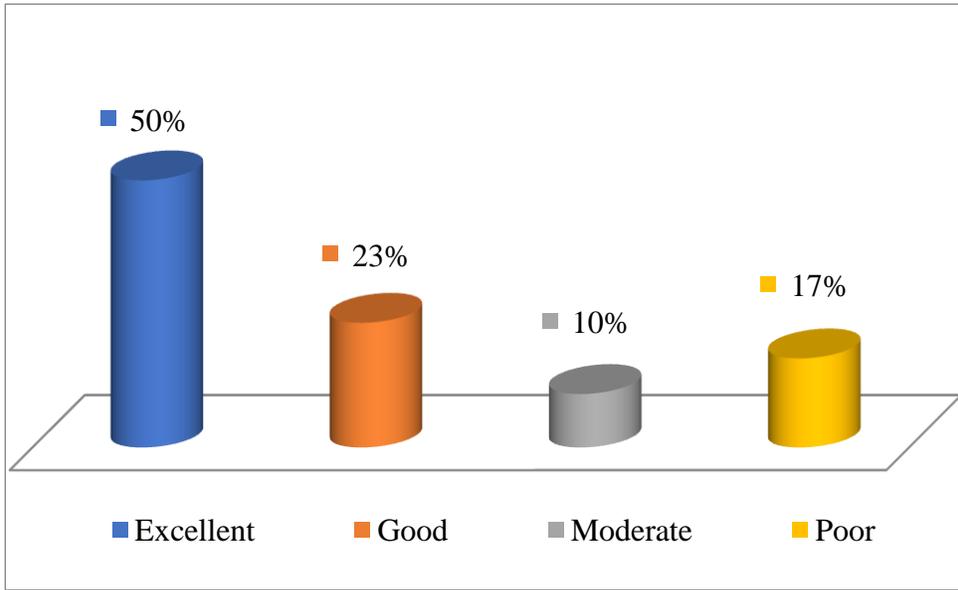
Gender	Years (mean age)	Number ofpatients	Percent
Male	63	14	47%
Female	62	16	53%

After 2 weeks the improvement was excellent (75-100%) in 14 patients (47%), good (50-70%) in 7 patients (23%), moderate (25-49%) in 7 patients (23%) and poor (less than 25%) in 2 patients (7%) (Figure1).



**Figure 1.** Improvement 2 weeks after the intervention

The improvement after 3 months was excellent (75–100%) in 15 patients (50%), good (50-70%) in 7 patients (23%), moderate (25-49%) in 3 patients (10%) and poor (less than 25%) in 5 patients (17%) (Figure2).



**Figure 2.** Improvement 3 months after the intervention

The level of compression of the L3-L4 nerve root was the cause of pain in 6 patients, the L4-L5 nerve root was painful in 13 patients and the level of L5-C1 nerve root in 11 patients (Table 2).

**Table 2.** Number of patients by level of conflict

Level of conflict	Number of patients
L3-L4	6
L4-L5	13
L5-S1	11

The results of the functional assessment analyzed by the Oswestry Disability Index (ODI) showed a significant improvement in the functional status after 3 months compared to the baseline. The improvement of their functional status according to the ODI score was at least 40% in 73.3% and 86.5% of patients after 2 weeks and after three months, respectively (Table 3).

**Table 3.** ODI score reduction

Monitoring time	Total no. of patients	Number of patients with improvement over 40%	Number of patients with improvement over 40% expressed in percentage
2 weeks	30	22	73.3%
3 months	30	26	86.5%

The median time for performing the intervention in this study was 16 min. During or after the intervention, 6 (20%) patients developed transient neurological deficits that included mild pain, paresthesia, and weakness on the side of the affected and treated radix. It lasted maximum 8-12 hours, after which it completely disappeared. The information was based on patient monitoring with a follow up enquiry on the telephone, after 24 and 48 hours.

Nerve root damage during the intervention, puncture of the subarachnoid space, soft tissue damage, blood vessels, or prolonged bleeding were not observed during the study.

None of the patients underwent classical surgical treatment. No permanent complications were observed during the study.

### **Discussion**

Lumbar pain is undoubtedly one of the most common health problems, experienced by 50-80% of the adult population at some point in their lives. It has become a serious health and socio-economic problem of modern men and women [5]. More than 50% of patients with symptoms of lumbosciatica reported reduced quality of daily living and working activities [6].

The working-age population is the most vulnerable group suffering from chronic lumbar pain, which is ranked as the leading cause of disability compared to any other condition globally [7].

Historical analysis has shown that epidural steroid applications have been used to achieve greater efficacy as a supplement to the treatment of resistant radiculopathy with a success rate of 20% to 80% [8-10].

They have been in use and have been regularly administered since 1952 and are still an integral part of the non-surgical treatment of chronic lumbar pain and radiculopathy [11].

Selective blocks have been used to map sensory dermatomes of the lumbar and cervical nerve roots; however, new scientific evidence suggests that the dermatome has not always been monitored [12].

The use of transforaminal infiltrations has been met with great success given the fact that strict monitoring under the CT scan ensures high accuracy and precision in cocktail administering at the lateral epidural site level [13]. Various studies have shown that topical application of an anaesthetic and corticosteroid may provide pain relief in the short or long term [14].

PRT in patients with painful lumbar syndrome and radiculopathy has been used as a preoperative evaluation of surgical candidates in some cases due to the incompatibility of the imaging methods with the clinical manifestation [15].

Mechanical compression of the extraforaminal nerve root with consecutive mechanical radiculitis plays an essential role in the progression of lumbosacral pain, as confirmed by many studies [16].

Selective epidural corticosteroid blocks have a therapeutic effect on the lumbosciatic discogenic pain and may prevent surgery [17].

The high efficacy of periradicular infiltration can be explained by the presumed mechanism of action determined by the correct application of a cocktail of corticosteroids and analgesics, since both have nociceptive properties, stabilizing properties of the nerve membrane for reducing the level of inflammation and mediators such as interleukin-1, prostaglandins, proinflammatory mediators, tumor factor necrosis, and phospholipase A2, along with the potent anti-inflammatory properties of steroids [18].

It remains unclear whether acute inflammation is the cause of sudden onset of disc herniation pain or foraminal stenosis [19]. Our results support the inflammatory mechanism hypothesis since 50% of our patients have had a rapid and almost complete pain relief after the introduction of the steroid and anesthetics.

In our study, improvement after 2 weeks was significant in 47% of subjects with a rapid reduction in pain, which is approximately the same as in the larger study by Timothy *et al.* [20].

After the third month of the intervention, we received a significant improvement in 50% of patients and the results are close to a prospective analysis that included 219 respondents where a significant improvement was observed in 56.6% of respondents after the third month. [21].

The effectiveness in our study was over 75% pain reduction in 50% of patients. The results obtained in this study support the inflammatory mechanism hypothesis, since about 50% of patients had a rapid pain reduction or almost complete pain relief after the application of corticosteroids and anesthetics. The survey showed an improvement in functional and operational status according to the ODI index by about 40%, which speaks in favor of a significant improvement in the quality of life and the fast return to daily work activities.

This study has several drawbacks, including the relatively small group of patients, the fact that the study focused only on the extraforaminal disc herniations, and the absence of a control group.

In cases where traditional treatment does not meet expectations, the pain persists with an increased intensity; there are symptoms such as cauda equina or a severe degree of sensory and motor deficit, and hence surgical treatment is absolutely indicated [22]. A large number of patients recover spontaneously, but in 1-3% of patients each year surgical treatment is indicated [23].

Despite these few drawbacks of the study, there is still ample evidence in literature confirming that periradicular infiltration is an effective, safe, and minimally invasive intervention and deserves to be part of the conservative management in patients with lumbosciatic pain, before planning to conduct more invasive methods.

### Conclusion

CT-guided PRT in patients with lumbar pain and radiculopathy is a safe and effective therapy and procedure. PRT is the first method of choice before planning surgical treatment in patients with radiculopathy caused by disc herniation. The benefit to patients with extraforaminal disc herniations is considerable. Many PRT-treated candidates are expected to avoid surgical treatment. The method would mean a significant reduction in postoperative complications and all financial burdens related to the surgical treatment.

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