

## IMPORTANCE OF PAIN DURATION PRIOR PAIN RELIEF TREATMENT WITH CT-GUIDED PERIRADICULAR THERAPY IN PATIENTS WITH CHRONIC LUMBAR PAIN

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### Abstract

CT-guided periradicular therapy (PRT) is a minimally invasive interventional technique for treatment of chronic lumbar pain.

**Aim:** To investigate importance of pain duration before PRT treatment in patients with chronic lumbar pain and radiculopathy, with clinical effectiveness assessment.

A prospective follow-up CT guided PRT study was done in 166 patients divided into 4 groups according duration of pain before intervention (<3 months, 4-6months, 7-12months, >1year). Degree of pain intensity was determined according to VAS scale. Improvement degree was excellent, good, moderate, or weak. Good clinical response was defined when improvement is greater or equal to 50% on VAS scale, and functional improvement was equal to 40% in the reduction of the ODI index. Follow-up was done at 2nd weeks, 3 and 6 months.

Good response was observed in 51.8% of the cases after 2 weeks, 54.2% after 3 months and 59% after 6 months. ODI index parameters was greater or equal to 40% in 22.2% after 2 weeks, 13.8% after 3 months, and 8.4% after 6 months. After 6 months in patients with pain duration up to 3 months, the improvement was excellent in 41(74.5%), moderate in 3(5.4%), good in 6(10.9%) and weak in 4(7.2%) patients in contrast to patients with pain over one year who showed excellent improvement in only 2(5.7%) patients, moderate in 11(31.4%), good in 6(17.1%) and weak in 16 (45.7%) patients.

PRT is clinically effective with better clinical outcome in patients with shorter duration of symptoms.

**Keywords:** chronic lumbar pain, radiculopathy, CT guided, interventional, steroids

### Introduction

Chronic lumbar pain and radiculopathy is a clinical lumbar pain syndrome followed by limb pain involving sensory or motor deficit on the affected side lasting for more than 12 weeks. When pain reduction is insignificant after exhausting the conservative treatment options involving oral analgesics, anti-inflammatory drugs, or their systemic application, a minimally invasive intervention like selective periradicular application at the level of the compressed nerve root is a treatment option[1].

Periradicular therapy (PRT) is a radiological, CT-guided method of treatment that includes chronic spinal pain therapy, usually due to disc herniation, disc swelling, or degenerative changes. It is a minimally invasive CT guided technique, using a thin needle for approaching to affected nerve root for administration of medications[2].

CT guidance afforded maximum accuracy, superior anatomical orientation with minimal complications[3].

A medication cocktail consisted of an anaesthetic and corticosteroid introduced 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 investigate the dependence of pain duration before PRT treatment in patients with chronic lumbar pain and radiculopathy with clinical effectiveness assessment.

## Materials and methods

This non-randomized prospective study includes 166 patients with chronic lumbar or radicular pain, consisted of 54.2% (90 pts) male and 45.8% (76 pts) female patients, with age range from 21 to 83 years (mean age of  $57.3 \pm 13.4$  years). The average duration of pain before treatment was  $8.3 \pm 6.9$  months.

Inclusion criteria were: radiculopathy that were not resolved after conservative treatment in a timeframe within not more than 4 weeks, treated with analgesics, anti-inflammatory drugs, and physical therapy, than clinically suggested lumbar radiculopathy and confirmed on MRI with presence of disc herniations, with mechanical radix compression that corresponds with clinical symptoms.

Exclusion criteria were: allergies, pregnancy, and absence of indicators of radix compression on MRI (magnetic resonance imaging), as well as other pathological conditions that may give identical symptoms, than anticoagulant treatment, metabolic radiculopathy and insulin diabetes.

The intensity of pain was scored according to VAS scale (visual analogue scale) as very strong, strong, average and weak.

Functional status was assessed according to the Oswestry Disability index 2.0 (ODI) [5] in all patients before the treatment.

According to the duration of pain before the intervention, patients were divided into 4 groups: up to 3 months, from 4-6 months, 7-12 months and over one year.

All patients underwent MRI one month before the intervention in order to prove presence of disc herniation with or without nerve root compression. The MRI scan protocol included: T2 WI in sagittal and transverse planes, T1 WI in sagittal plane and TIRM T2 in sagittal plane.

All patients clinically were examined by a neurologist, neurosurgeon, and radiologist, and EMG (electromyography) was done. Final decision for treatment was made based on the Medical Evaluation Advisory Board opinion.

One week after finishing with a full conservative treatment with analgesics, anti-inflammatory drugs, intramuscular administration of medicine, and physical therapy treatment PRT was performed.

VAS and ODI index was followed-up and were assessed on the 2nd week, 3th month and 6th month after the intervention.

The degree of improvement was assessed as excellent (over 75%), good (50-70%), moderate (25-49%), weak (less than 25%).

## CT guided periradicular therapy technique

Prior intervention, the information was given to all patients, regarding technical part, benefits, expectations and potential complications that may occur during and after the procedure and a written statement was signed.

After comfortable positioning of the patient in prone position, the local skin marker is placing along the posterior median line at the lumbar region.

A quick-check CT scan was used with slices thickness of 2mm and field of view at the level of interest, in order to define an application site and plan the insertion angle of the needle.

After local disinfection, a subcutaneous local anesthetic of 3ml Lidocaine, is applying. The procedure continued with the CT-guided introduction of an introducer (18 gauge needle) to reach the peripheral muscle fascia.

Then the tip of the longer needle (chiba) is CT-guided till the facet joint at the level of the neural foramen with positioning at the lateral epidural space.

The procedure continued by anesthetic application (3ml Bupivacaine), followed by application of corticosteroid (2ml Kenalog). Monitoring of the patient is within the next two hours.

## Results

This research included 166 patients with chronic lumbar or radicular pain treated with the periradicular therapy. The patients were aged 21-83 years, the mean age being  $57.3 \pm 13.4$ , and the average BMI  $26.1 \pm 1.8 \text{ kg/m}^2$ . The gender structure of the sample was composed of 90(54.2%) male and 76(45.8%) female patients, and previous surgeries was performed in 16.3% (27pts) of the cases.

For assessment of pain intensity patients answered a visual VAS scale. Accordingly, the most of them had a severe pain 46.4% (77 pts). On a scale of 1 to 10, the intensity of pain was assessed with a score of 5 by 50% of the patients. The average score was  $5.07 \pm 1.9$  (table 1).

**Table 1.** Pain intensity before treatment

<b>Pain Intensity (VAS)</b>	<b>Number of patients (%)</b>
Very strong / n (%)	31 (18.6%)
strong/n (%)	77 (46.3%)
average/n (%)	54 (32.5%)
weak/n (%)	4 (2.4%)
<b>Score of pain n (%)</b>	
mean $\pm$ SD	$5.07 \pm 1.9$
median (IQR)	5 (2 - 9)

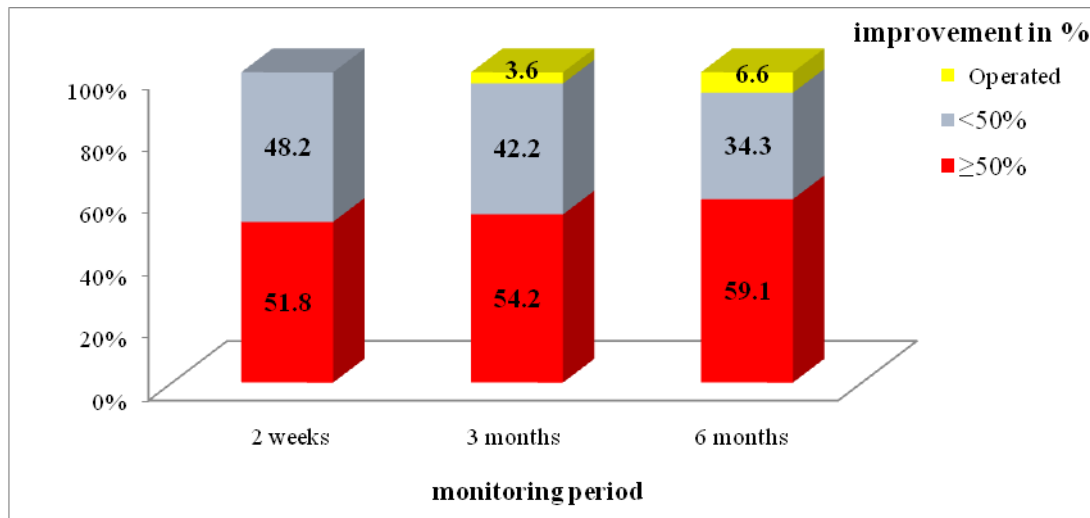
The average pain duration was  $8.3 \pm 6.9$  months; 1 month was the shortest pain duration, the maximum pain duration was 36 months; 21.1% (35) of patients had pain for more than 12 months (table 2).

**Table 2.** Average pain duration before treatment

<b>Groups</b>	<b>Pain duration (months)</b>	<b>Number of patients (%)</b>
<b>I</b>	0 - 3/n (%)	55 (33.1%)
<b>II</b>	4 - 6/n (%)	34 (20.4%)
<b>III</b>	7 - 12/n (%)	42 (25%)
<b>IV</b>	> 12/n (%)	35 (21%)
(mean $\pm$ SD) (min-max)		$(8.3 \pm 6.9)$ (1 - 36)
media (IQR)		6.0 (3.0 - 12.0)

There was a statistically significant reduction in the mean value of the VAS and ODI index 2 weeks, 3 and 6 months after the intervention.

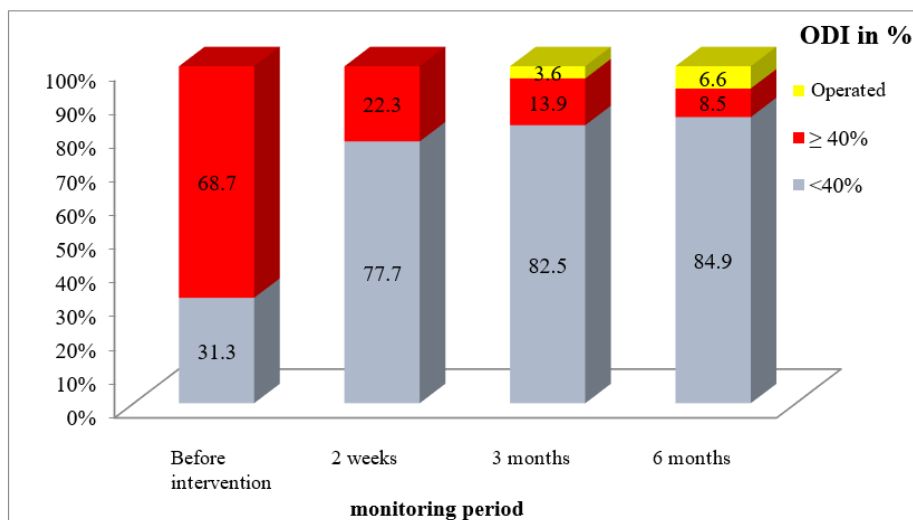
According to VAS, a good response was observed in 51.8% after 2 weeks, 54.2% after 3 months and 59% of the patients after 6 months (Fig. 1).



**Figure 1.** Percentage improvement according to VAS. Performed operative treatment 3 to 6 months before the intervention (yellow)

A statistically significant difference was confirmed in the distribution of patients with ODI index lower and higher than 40% in the analyzed period ( $p < 0.0001$ ).

ODI index lower than 40%, which is equivalent to a better functional was significantly more often registered 6 months after the intervention compared to the functional result before the intervention, 2 weeks, and 3 months after the intervention. 22.29% of patients had an ODI greater or equal to 40% after 2 weeks, 13.86% after 3 months, 8.43% after 6 months, respectively (Fig. 2).



**Figure 2.** Percentage improvement according to ODI index. Performed operative treatment 3 to 6 months before the intervention (yellow)

There is statistically significant difference between pain duration and post-interventional improvement, which showed that shorter pain duration before treatment was associated with a greater improvement. In patients with a good VAS and ODI, the improvement was greater when the pain duration interval was shorter as well.

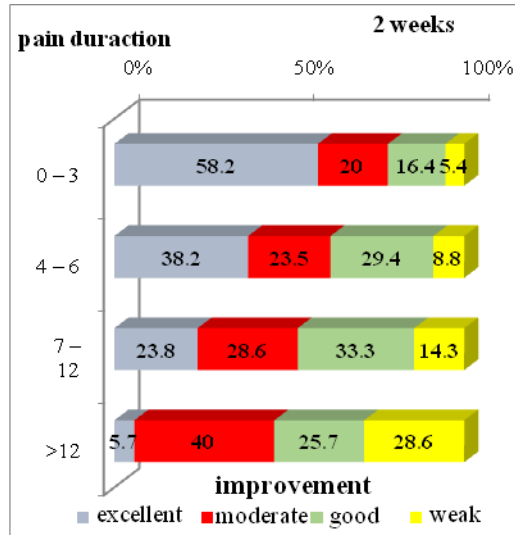


Figure 3. Improvement after 2 weeks

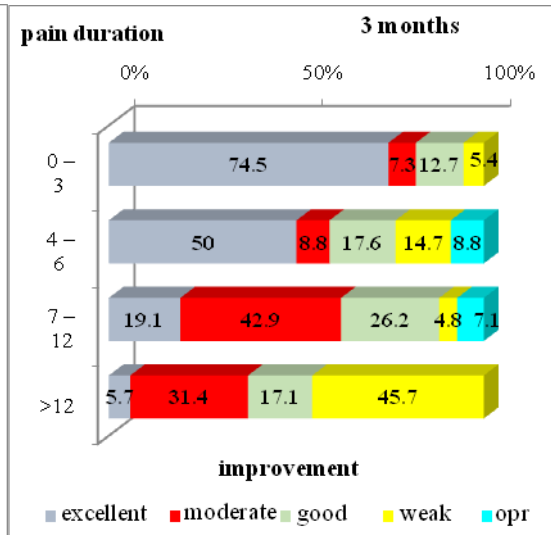


Figure 4. Improvement after 3 months

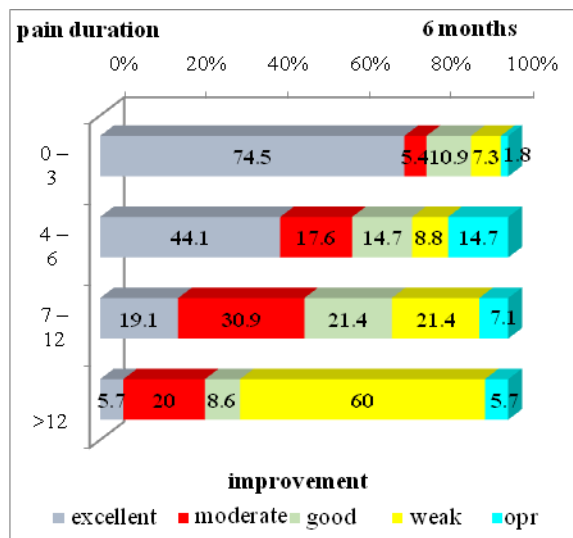


Figure 5. Improvement after 6 months

Two weeks after PRT, in patients with pain duration of up to 3 months before PRT, the improvement was excellent in 32 patients (58.2%), moderate in 11 (20%), good in 9 (16.4%) and weak in 3 patients (5.5%) in contrast to patients with duration of pain over 1 year prior PRT who showed improvement assessed as excellent only in 2 patients (5.7%), moderate in 14 (40%), good in 9 (25.7%) and weak in 10 patients (28.6%) (Fig.3).

Three months after PRT, in patients with pain duration up to 3 months before PRT, the improvement was excellent in 41(74.6%), moderate in 4(7.3%), good in 7(12.7%) and weak in 3(5.5%) patients, in contrast to patients with duration of pain prior PRT over 1 year that showed excellent improvement only in 2(5.7%) patients, moderate in 11 (31.4%), good in 6(17.1%) and weak in 16 (45.7%) patients (Fig.4).

Six months after PRT, in patients with pain duration up to 3 months before PRT, the improvement was excellent in 74.6% of the cases (41 pts), moderate improvement had in 3(5.4%), good 6(10.9%) and weak improvement had 4(7.3%) patients. In contrary, patients with pain over 1 year before PRT, that showed excellent improvement in only 5.7% (2 patients), moderate in 11(31.4%), good in 6(17.1%) and poor in 16(45.7%) patients (Fig.5).

The median time for performing the intervention was 16 min.

During or after the intervention, 20% of patients developed transient neurological deficits that included mild pain, paraesthesia, and weakness on the side of the affected and treated radix. It lasted a maximum of 8-12 hours, after which it completely disappeared.

The information was based on a patient monitoring with a follow-up inquiry on the telephone, after 24 and 48 hours. Complications like nerve root damage during the intervention, puncture of the subarachnoid space, soft tissue damage, blood vessels, or prolonged bleeding were not observed in all patients.

### Discussion

Lowerback pain is one of the most common condition that every person faces in the course of his/her life and one of the most common reasons to visit a doctor. The frequency is so high that it is believed that about 80% of the population have had at least one episode of lowerback pain in their lifetime of various degrees and forms [6].

The working age adult population is the most vulnerable group affected by the lowerback, which is ranked as the highest cause of disability of any other condition globally [7].

Mechanical compression of the nerve root with consecutive mechanical radiculitis plays an essential role in the progression of lumbosacral pain, as has been confirmed by many studies [8].

Various studies have shown that topical application of anesthetics and corticosteroids may provide pain relief in the short or long term [9].

Historical retrospective analysis has shown that epidural corticosteroid applications are used as a support in the conservative management of chronic resistance radiculopathy with a success rate of 20% to 80% [10,11].

It was introduced in clinical practice in 1952 and are still an integral part of the non-surgical treatment of chronic lumbar pain and radiculopathy. 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 side level [12].

The motive or reason for the use of transforaminal epidural applications is related to the fact that radicular pain is caused by inflammation of the nerve roots as a result of an inflammatory response to the herniated disc material. This fact has been confirmed by much evidence in a number of laboratory studies [13,14,15].

Transforaminal epidural applications are effective in the treatment of chronic lumbar and radicular pain, which has been confirmed in many scientific studies [16,17,18].

One of them is the systematic analysis of MacVicar *et al.* that included 12 observational studies. The study confirmed the consistent image of efficacy, with about 70% of respondents experiencing at least a 50% pain reduction [19]. Our study has confirmed the validity of PRT as an effective treatment for pain reduction. The results have shown that more than 50% of treated patients experienced pain reduction after 2 weeks, 3 and 6 months (56.63%, 59.45% and 60.18%, respectively).

Our results are consistent with many studies and one of them is the study of Ghahreman *et al.* It included 150 subjects, of whom 54% showed pain reduction after 1 month. It was an early

observational study that confirmed the superiority of the transforaminal approach associated with the best results [20].

One of the largest studies with an analysis of 3,110 subjects was conducted by Kaufmann *et al.*[21], showed a significant pain reduction and improvement in functional status after 2 weeks and 3 months. According to VAS, 40.9% showed a good response after 2 weeks and 45.6% after 2 months, and with respect to the functional status 31.9% after 2 weeks and 41.3% after 2 months.

Our study showed a pain reduction after 2 weeks of 51%, after 3 months 54%, and with respect to the functional status 19%, 13% after 2 weeks and 3 months, respectively. The results of the study are consistent with results in the study of Şencan *et al.*[22] where a significant pain reduction and improvement of the functional status with a good response was registered, with 54% improvement registered after 2 weeks and 58% after 2 months. Therefore, the results are in agreement with our study results.

Several studies have confirmed that prolonged symptoms adversely affected the outcome [23,24]. The subjects' results were better when the pain duration was less than 3 months compared to the subjects who had symptoms with pain duration of more than 3 months. In Kaufmann *et al.*'s study 62.4% (56.5, 68.3%) showed a good response according to VAS under 3 months and 40.6% (37.2,44.0%) over 3 months In Ghahreman *et al.*'s study 47% (25-69%) of subjects under 3 months and 55% (22.88%) with pain for more than 3 months correlated with our results which were 82.9% for subjects with pain for up to 3 months and 44.5% with pain for more than 3 months.

This has already been observed by Ng *et al.*,[25]. In a very small group of 25 patients with disc herniation, Vadat *et al.* [26] noted a reduced effect in patients with prolonged pain for more than 1 year. Lutz *et al.* [27] in a group of 69 patients with disc herniation noted that the duration of symptoms before the intervention for more than 24 weeks did not correspond to good results after intervention.

Karppinen [28] in his study reported a 45% improvement after 2.4 months of the average duration of pain in the study group while Ng *et al.* noted a 25% improvement in more chronic patients (16.9 months).

The chronic prolonged compression in disc herniation leads to microvascular traumatic lesions that causes ischemic changes, edema, and demyelination of the nerve root [29].

Irreversible neurophysiological alterations associated with chronic inflammation and irritation as a result of prolonged compressive effect may have a significant effect on the anatomical and physiological protective layers of nerve roots thereby reducing the protective barrier resulting in greater vulnerability and corticosteroid resistance [30].

In our study, the previous mentioned mechanism can be the explanation of the final weak improvement in the group of the patients who had longer duration of symptoms before the intervention.

After early transforaminal epidural corticosteroid applications in patients with radiculopathy, a significant pain reduction and neurological and functional status improvement is reported [31].

Our study showed that the post treatment effect is significantly better when the PRT is performed after conservative treatment including physical therapy is without significant pain improvement. Patients who had a shorter duration of symptoms before the intervention showed better results.

### **Conclusion**

CT-guided PRT is effective minimally invasive method in patients with lumbar pain and radiculopathy.

Effectiveness of the method is very much dependent on pain duration before treatment.

With this technique best results can be achieved if it is performed sooner after conservative treatment and physical therapy does not improve the clinical symptoms of the patient.

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