Intradiscal Steroid Injection for the Treatment of Neuropathic Pain Due to Discogenic Low Back Pain

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ABSTRACT

Background: The aim of the present study was to investigate the effectiveness of intradiscal steroid injection in the treatment of discogenic low back pain (DLBP) with neuropathic pain (NeP).

Methods: A total of 18 patients with DLBP were enrolled and divided into two groups based on having NeP and not. The patients' records included the following clinical parameters: duration and intensity of LBP, the Quebec Back Pain Disability Scale [QBPDS], the Daily Sleep Interference Scale [DSIS] and a Leeds Assessment of Neuropathic Symptoms and Signs [LANSS] pain scale.

Results: In our study, 38.8% of the patients had DLBP with NeP, whereas 61.2% had mainly nociceptive pain. As we investigated the mean changes of the QBPDS scores and intensity of LBP in patients with a LANSS score ≥12, a statistically significant reduction was found at the second week and third month after the treatment compared to pre-injection values ($p<0.05$). The mean reduction in the intensity of DLBP, the QBPDS scores and the DSIS scores from baseline to second week and third month after the treatment was greater in group 2 than in group 1.

Conclusions: Intradiscal steroid injections appear to be an effective and promising treatment for NeP component in DLBP.

Keywords: Discogenic, intradiscal low back pain, neuropathic, pain,

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INTRODUCTION

Discogenic low back pain (DLBP) −pain caused by a degenerated intervertebral disc− is the most common type of chronic low back pain (CLBP). The prevalence of DLBP is reported to be 39% (1). The treatment of DLBP continues to be a challenge for clinicians. Some recent clinical studies have investigated that some interventional treatment methods for DLBP are effective, including intradiscal steroid injection and radiofrequency thermocoagulation (2); however, findings regarding treatment outcome are inconsistent.

Neuropathic symptoms are reported in 16%-55.6% of CLBP patients with and without radiating leg pain (3-5). The theoretical consideration of nerve roots as the only cause of neuropathic pain (NeP) in LBP is incorrect. Regarding the pathogenesis of degenerative and painful discs, it was reported that intervertebral discs have nerve ingrowth into the inner layers of the annulus fibrosis (6); as such, the intervertebral disc itself can be a source of NeP in patients with CLBP. It is important to identify neuropathic components of DLBP, because conventional analgesic treatment may be less effective in such patients; however, there is strong evidence that supports treating NeP using opioids, tricyclic antidepressants, and anticonvulsants (7, 8).

DLBP can be pain that consists of both nociceptive and neuropathic components. Although the contribution of NeP to DLBP is not completely understood, it is thought that the lesions of nociceptive sprouts in degenerated discs and the release of inflammatory mediators from degenerated discs may cause NeP. An inflammatory response was reported to be the primary pathophysiologic mechanism of DLBP (1). As steroids have an anti-inflammatory effect, it is natural to assume that intradiscal injection of steroids would be effective in the treatment of DLBP; however, their efficacy has not been proven and their mechanism of action remains to be clarified. Although few studies have shown the treatment efficacy of intradiscal

steroid injection, the effectiveness of the treatment is still controversial (9,10). To date, no study has sought to determine if intradiscal steroid injection can effectively treat DLBP with NeP. The present study's hypothesis was that intradiscal steroid injection could effectively treat DLBP with NeP via inhibition of the inflammation thought to play a major role in the formation of NeP in DLBP.

The primary aim of the present study was to investigate the effectiveness of intradiscal steroid injection in the treatment of DLBP with NeP. Secondary objectives were to investigate the frequency of NeP in patients with DLBP, and to determine if there are differences in the characteristics of patients' low back complaints, including duration and intensity of LBP (with and without radicular pain) between DLBP patients with and without NeP.

MATERIALS AND METHODS

The Ethics Committee of the Gulhane Military Medical Academy approved this pilot study's protocol and all patients provided written informed consent to participate. Patients that fulfilled the following criteria were included in the study: 1. No response to previous conservative treatment; 2. MRI findings indicative of degenerative disc disease (DDD); 3. Positive response to a provocative discography. Exclusion criteria were age <18 years and >60 years, history of lumbar surgery, ≥50% decrease in intervertebral disc distance based on MRI, and history of sacroiliitis, infectious, or neoplastic spinal disease. Patients with general contraindications for fluoroscopy-guided injection, such as pregnancy, contrast material allergy, and coagulopathy, were also excluded from the study. In total, 18 patients with DLBP were enrolled and divided

into 2 groups according to NeP status. Group 1 included 11 DLBP patients without NeP and group 2 included 7 DLBP patients with NeP.

Intradiscal steroid injections were performed at our interventional pain unit by an experienced physiatrist. Each patient was positioned in the prone position, and then the intervertebral disc level targeted for provocative discography was selected according to MRI findings of degenerative disc changes that were consistent with LBP. To determine the control disc level for provocative discography, we selected the intervertebral disc level adjacent to the pathological level. After the target level was set up fluoroscopically, an oblique fluoroscopy view was used. The fluoroscopy image intensifier (C-arm) was tilted cranially or caudally until the superior and inferior endplates appeared parallel to each other, so that the superior articular process of the overlying facet joint was positioned over the middle of the intervertebral disc space. The skin was marked just lateral to the superior articular process. After skin and deep tissue were anesthetized with local anesthetic (2 cc of 1% lidocaine, without epinephrine), a 22G × 5-inch needle was advanced along the X-ray beam toward the disc. Needle-tip placement into the center of the disc was confirmed in the anteroposterior and lateral views before intradiscal injection of 1-2 mL of iohexol (300 mg mL^{-1}) (Figure 1A and B). For a positive discography, patient must have a pain of ≥6/10 in the pathological level and not in the control level. After identification of the pathological disc level, 1 cc of betamethasone was injected into the disc.

The following data were obtained from patient records: duration and intensity of LBP, Quebec Back Pain Disability Scale [QBPDS] score, Daily Sleep Interference Scale [DSIS] score, and Leeds Assessment of Neuropathic Symptoms and Signs [LANSS] pain score. All outcome parameters were recorded at baseline, and 2 weeks and 3 months post treatment. In addition,

patients were asked if they had LBP with radicular pain or not. Sensitivity to touch, pinprick, and brush was determined via physical examination.

A visual analog scale [VAS] was used to assess change in the severity of LBP. A VAS is usually a horizontal line 100 mm in length; patients mark a point on the line that represents their current level of pain. A score of 0 mm indicates no pain and a score of 100 mm corresponds to the worst possible pain. The LANSS pain scale was used to identify DLBP patients with NeP. The scale is a useful for differentiating patients with NeP and those with nociceptive pain, and is based on analysis of sensory description and bedside examination of sensory dysfunction. The maximum LANSS total score is 24; a score <12 indicates that neuropathic mechanisms are unlikely to be involved in the patient's pain and a score ≥ 12 indicates that neuropathic mechanisms are likely to be involved. LANSS was reported to be reliable and valid in the Turkish population by Yucel A. et al. (11).

The QBPDS is a 20-item self-report instrument designed to assess the level of functional disability in individuals with LBP. The scale is a reliable and valid measure used to monitor the progress of patients during the treatment process. The scale's 20 items are scored using a 6-point Likert-type scale of 0 (no disability)-5 (impossible to do). The QPBDS minimum score is 20 and the maximum score is 100. Higher scores indicate more severe disability (12). DSIS was developed to evaluate sleep interference due to pain. The mean sleep interference score is rated on an 11-point Likert type scale that describes the extent to which pain has interfered with a patient's sleep during the previous 24 h. Response options range from 0 (pain does not interfere with sleep) to 10 (pain completely interferes with sleep).

Statistical analysis was performed using SPSS v.15.0 for Windows. Quantitative variables are shown as mean ± SD (range). Qualitative variables are shown as proportion and

percentage. The independent samples t-test was used to compare quantitative data between the 2 groups. Intra-group differences in outcome were compared using the paired samples t-test. Comparison of qualitative data was performed using Pearson's chi-square test. The power of 0.97 was based upon a study power calculation, with an anticipated mean difference of 12 ± 13 in the outcome parameters between the 2 groups, allowing for a P value of 0.05 and a sample size of 18.

Results

Mean age of the 18 patients (9 male and 9 female) was 43.7 ± 12.7 years (range: 24-60 years). In all, 38.8% of the patients had DLBP with NeP, whereas 61.2% had nociceptive pain. In total, 8 (44.4%) patients had radicular LBP, 6 (33.3%) had axial LBP, and 4 (22.3%) had axial LBP with referred pain. The posterior surface of the thigh was the most common (62.5%) region of referred pain in the patients with DLBP, followed by the gluteal region (25%) and anterior surface of the thigh (12.5%).

The rates of radicular pain and altered pinprick test results were significantly higher in group 2 than in group 1 ($P = 0.003$ and $P = 0.01$, respectively). QBPDS and DSIS scores were higher in group 2, but the difference was not significant ($P > 0.05$). There weren't any significant differences in the duration or intensity of LBP between the 2 groups. All the between-group comparisons are shown in Table 1. Comparison of LANSS scores in group 2 before and after treatment with intradiscal steroid injection showed that 2 weeks and 3 months post treatment 4 patients had a LANSS score <12 and that the number of patients with NeP due to DLBP decreased by 57.1%, whereas 3 (42.9%) of 7 patients still had a LANSS score ≥12.

We investigated the mean changes in QBPDS scores and severity of LBP in patients with a LANSS score ≥12, and a statistically significant reduction was noted 2 weeks and 3

months post treatment, as compared to pre-injection values ($P < 0.05$); however, there wasn't a significant difference in the mean reduction in DSIS scores 2 weeks and 3 months post treatment ($P > 0.05$) (Table 2). Mean reduction in the severity of DLBP, QBPDS scores, and DSIS scores from baseline to 2 weeks and 3 months post treatment was greater in group 2 than in group 1; however, there wasn't a significant difference in the mean reduction in outcome parameters between the 2 groups ($P > 0.05$) (Table 3).

DISCUSSION

To the best of our knowledge the present study is the first to investigate the effectiveness of intradiscal steroid injection for treating DLBP with NeP. The present findings show that intradiscal steroid injection resulted in a significant reduction in QBPDS scores and severity of LBP in patients with NeP due to DLBP. In addition, the mean reduction in sleep interference scores, QBPDS scores, and severity of LBP from baseline to 2 weeks and 3 months post treatment was greater in the DLBP patients with NeP than in those without NeP; however, there wasn't a significant difference in the mean reduction in outcome parameters between the 2 groups.

DLBP is often characterized by both nociceptive pain and NeP components (mixed pain). Although the literature includes some data on the prevalence of DLBP, less is known about the NeP component as a contributing factor. In the present study 38.8% of the patients had DLBP with NeP. This high prevalence of NeP among DLBP patients might be considered a novel finding. The LANSS pain scale was used in the present study not only for differentiating between patients with NeP and nociceptive pain, but also for monitoring the efficacy of

treatment. LANSS scores before and after treatment were compared in order to determine the efficacy of intradiscal steroid injection for treating the NeP component of DLBP. Although most LBP patients with NeP respond well to some drugs, such as antidepressants and anticonvulsant drugs, there are no data on the effectiveness of intradiscal steroid injection for treating the NeP component as a contributing factor to DLBP (12). In the present study 57.1% fewer DLBP patients had NeP following intradiscal steroid injection treatment. The present findings show that intradiscal steroid injection is an effective and promising treatment for the NeP component in DLBP.

In the present study 44.4% of the patients with DLBP had radicular pain and 22.3% had axial LBP with referred pain, and the posterior surface of the thigh was the most common region of referred pain. Radicular pain is caused by irritation of the nerve roots and is usually associated with neuropathic mechanisms, and frequently radiates below the knee, whereas referred pain occurs without nerve involvement and rarely extends below the knee. In addition, referred pain might be predominantly nociceptive in nature (13). In the present study 85.7% of the patients in group 2 had radicular pain, versus 18.1% of the patients in group 1; the difference was significant ($P = 0.003$). This finding is consistent with earlier studies that suggest neuropathic mechanisms play a major role in LBP with radicular pain (14, 15).

Schulz et al. (16) reported that altered pin-prick test results were the most sensitive and specific finding for differentiating between patients with and without NeP. In another study the rate of altered pin-prick test results was 73.1% in LBP patients with NeP (17). Consistent with the findings of previous studies, 71.4% of the patients in group 2 of the present study had altered pin-prick test results, versus 27.2% of the patients in group 1; the difference was significant ($P = 0.01$).

Although some studies reported a significant difference in the duration and severity of LBP between patients with and without NeP (14, 18,19), in the present study there wasn't a significant difference in the duration or severity of LBP between the 2 groups. Those earlier studies showed that LBP patients with NeP had more severe pain and longer duration of pain than those without NeP; however, they included samples of patients with LBP, whereas the present study included a small sample of patients with DLBP. The lack of association between NeP, and duration of LBP or severity of LBP in the present study might have been due to the small sample and diagnostic heterogeneity of the original sample.

Some studies have shown that NeP has significant negative effects on functional disability and quality of sleep. It was reported that LBP patients with NeP are more likely to have more severe functional disability performing daily activities. In addition, the rate of sleep disturbances was higher in LBP patients with NeP than in those without NeP (14, 20). Consistent with these earlier findings, QBPDS and DSIS scores in the present study were higher in the DLBP patients with NeP than those without NeP. Although functional disability and sleep interference were more severe in the DLBP patients with NeP, the difference was not significant.

Limitations of the present study include the lack of a control group (no treatment) and the small sample. In addition, the assessment parameters were measured only at 2 weeks and 3 months post treatment; long-term results of the treatment were not evaluated.

In conclusion, the present findings show that a high percentage of the DLBP patients had a predominant NeP component. Based on the present findings, we think intradiscal steroid injection is an effective treatment for reducing NeP and NeP-related disability. The present findings are encouraging, but additional research with larger samples, longer-term follow-up, and

comparison with other interventional treatment methods and/or a placebo control group is warranted.

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Table 1: Comparison of demographic findings and LBP characteristics between the 2 groups.

Characteristics	Group 1 (N=11, 61.2%)	Group 2 (N=7, 38.8%)	Mean Difference (95%CI)	P
Age, years	43.82 ± 14.42	43.71 ± 10.32	0.11	0.98 [a]
Male, N (%)	7 (63.6)	2 (28.4)		0.09 [b]
Mean duration of LBP (months)	16.09 ± 17.64	16.57 ± 11.58	-0.48	0.95 [a]
Severity of LBP (VAS, mm)	57.36 ± 15.01	66.43±12.48	-9.07	0.87 [a]
Quebec Back Pain Disability Scores	30.64 ± 13.51	42.37 ± 15.55	-11.73	0.14 [a]
Sleep interference scores	4.91 ± 1.37	5.29 ± 1.79	-0.38	0.62 [a]
LBP with radicular pain, N (%)	2 (18.1%)	6 (85.7%)		**0.003** [b]
An altered PPT N (%)	3 (27.2%)	5 (71.4%)		**0.01** [b]

(a) As determined by the independent samples t-test, (b) As determined by the Pearson chi-square test, LBP: Low back pain, VAS: Visual Analog Scale, PPT: Pin-prick test. Bold values indicate a P value < 0.05.

Table 2: The Mean Changes of QBPDS Scores, DSIS Scores and severity of LBP in patients with a LANSS score ≥12.

	Baseline	Second week	P*	Third month	P*
Severity of LBP (measured by VAS, mm) [mean ± SD]	66.43 ± 12.48	38.75 ± 21.74	**0.018**[a]	47.50 ±11.90	**0.02**[a]
Quebec Back Pain Disability Scores [mean ± SD]	42.37 ± 15.55	25.75 ± 12.84	**0.002**[a]	21.25 ± 10.99	**0.007**[a]
Sleep Interference Scores [mean ± SD]	5.29 ± 1.79	4.79 ± 1.35	0.23[a]	3.85 ± 1.68	0.48[a]

VAS: Visual Analog Scale, SD: standard deviation, LBP: low back pain, P*: P value compared with baseline,
a: The paired samples t-test was used. Bold values indicate a P value < 0.05

Table 3: The mean changes of QBPDS Scores, DSIS Scores and severity of LBP in the two groups

	Group 1	Group 2	P*
Mean change in the severity of LBP (mean ± SD) (mm)			
From baseline to 2nd week	-27.50 ± 26.22	-29.54 ± 18.36	0.36
From baseline to 3rd month	-20.75 ± 20.31	-32.22 ± 30.01	0.44
Mean change in QBPDS scores (mean ± SD)			
From baseline to 2nd week	-10.36 ± 9.45	-14.66 ± 2.42	0.86
From baseline to 3rd month	-11.88 ± 12.23	-18.20 ± 5.11	0.38
Mean change in DSIS scores (mean ± SD)			
From baseline to 2nd week	-2.46 ± 1.35	-3.65 ± 1.48	0.35
From baseline to 3rd month	-2.05 ± 1.65	-3.25 ± 1.27	0.27

SD: standard deviation, LBP: low back pain, QBPDS: Quebec Back Pain Disability Scale, DSIS: Daily Sleep Interference Scale. *: The independent samples t-test was used

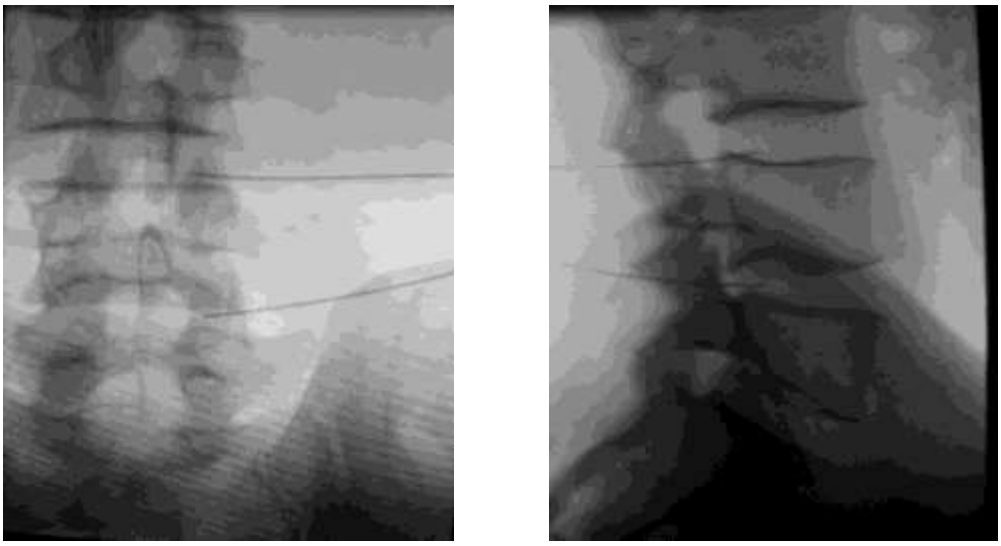

Fig. 1: Anteroposterior (A), lateral (B). Note final position of intradiscal spinal needles at L3-L4 and L4-L5 disc levels.