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Percutaneous Pain Procedures in Patients Who Underwent Lumbar Disc Herniation Surgery: Is It an Important Tool in the Management of Post-Surgical Ongoing Pain?

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ABSTRACT

AIM: Treatment of ongoing pain in patients undergoing disc surgery is extremely difficult, and there is no consensus. Our study aimed to evaluate the efficacy of percutaneous pain interventions in these patients.

MATERIAL and METHODS: We retrospectively analyzed 48 patients with persistent / recurring complaints who underwent lumbar disc surgery (LDS) and were treated with percutaneous interventions. They were grouped into recurrent disc herniations (RDHs) and other discovertebral pathologies (ODVP). Moreover, patients were evaluated as those who received transforaminal injection (TFI) with facet blockage (FB) and who received both caudal injection (CI) and TFI in addition to FB. Patients were evaluated using Oswestry Disability Index (ODI) and visual analog scale (VAS).

RESULTS: Between the recurrent and ODVP groups, preoperative, 1 h postoperative, and 6 mo postoperative ODI (p=0.867, p=0.055, p=0.892) and VAS (p=0.902, p=0.136, p=0.462) scores did not show a statistically significant difference, respectively. Additionally, in the comparison of patients who underwent FB+TFI+CI and only FB+TFI, there was no statistically significant correlation between preoperative and 6 mo postoperative ODI (p = 0.284) and VAS (p = 0.248) scores in both recurrent and ODVP groups, respectively. The success rates at the 3rd and 6th mo of patients with RDH and ODVP were 47.61% (10/21) and 42.85% (9/21) and 70.37% (19/27) and 63.96% (17/27), respectively.

CONCLUSION: There was no statistically significant difference in ODI and VAS scores between recurrent and ODVP groups. The clinical success rate was numerically better in the ODVP group. Thus, we suggest that co-administration of TFI and CI did not significantly contribute to our clinical outcome.

KEYWORDS: Back pain, Management, Postsurgical

INTRODUCTION

After lumbar discectomy (LD), low back pain (LBP) and radicular pain can recur in some patients, and the pain does not completely improve. Therefore, persistent pain after spine surgery is a common condition, and the prevalence rates range between 10% and 40% (13). While some patients with pain require re-operation, non-surgical treatments are beneficial for some. Recurrent lumbar disc herniations (RLDHs) are the most common condition requiring re-operation (5,27). RLDHs are considered as herniations at the same level and from the same side within the first 6 mo after LD and have an incidence rate of 2%–25% (5,27).

Other conditions requiring re-operation to re-evaluate the patients with persistent/ recurring complaints after LD are

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epidural fibrosis, adhesive arachnoiditis, isolated lateral spinal stenosis, and iatrogenic segmental instability (3,9,24,36). Among these pathologies, epidural fibrosis and segmental instability are the most common (3,9,24,36). The incidence of epidural fibrosis after LD varies between 18% and 37%, depending on the surgical technique (2). Different complications and outcomes have been reported in various studies (8,22,25). Although LD is the most common treatment for RLDHs requiring re-operation, anterior/ posterior interbody fusion and endoscopic minimally invasive interventions are also applied. Since the complication rates are higher and pain control is lower in patients who undergo re-operation, patient satisfaction is lower than in the first operation (3,27). Regarding pain is predominant without new neurological deficits in most patients whose complaints recur due to RLDH/ other reasons and require treatment (19,31). Therefore, pain management gains importance in the treatment of such patients. In pain management, epidural injections (EIs) with much lower complication rates and patient costs are performed (19,31). EIs are especially important in providing pain control in patients who are obese, have comorbidities, and are predicted to be at high risk for secondary surgical intervention (19,31). EIs can be administered through three different access routes: transforaminal, interlaminar, and caudal (19,31). With TFI, steroids and local anesthetic agents are administered to the proximal part of the dorsal root ganglion and nerve root (19,31). Local anesthetic agents provide pain control by regulating nerve conduction with "neuroversion" in the epidural area (4). The epidural drug mixture is administered to the anterior epidural area by spreading from the distal to proximal by CI (19). It is thought that steroids provide anti-inflammatory effects by inhibiting inflammatory mediators around the epidural area and neural tissue (19,31).

This study aimed to evaluate the efficacy of TFI with facet denervation (radiofrequency median nerve block) or transforaminal and caudal epidural injection applications with facet denervation of patients who were divided into two groups (recurrence and ODVP) in lumbar magnetic resonance images (MRIs) of patients with evolving low back and leg pain complaints after LD.

MATERIAL and METHODS

Between January 2016 and January 2020, patients were who referred to the neurosurgery clinic with complaints of low back and leg pain and had a history of LDS and whose complaints were found to be related to the operative level included in the study group of interventional pain treatment procedures.

A list of patients who underwent interventional pain treatment was obtained using the hospital database. It was shown that patients' complaints were related to the level at which they were operated for lumbar disc herniation (LDH) by neurological examination and neuroradiological findings. In addition to the patient information system of the hospital, the data bank of the national health system was also used in this retrospective study. After the patient data were collected, 48 patients who could be reached by phone and were in accordance with the criteria were included in the study.

Institutional ethics approval was obtained from the local ethics committee (approval date: 26.05.2021, project number: 283). Oral and written informed consent was obtained from all patients. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Interventional pain management was applied to patients who had low back and leg pain that was similar to that before LD, had neurological examination findings related to the operative level, and had hemipartial or total laminectomy defect in radiologic images that were related to the neurological findings and did not benefit from at least 4 weeks of medical treatment and/or physical therapy. The accepted neurologic examination findings are positivity of neurological provocation tests, hypoesthesia in the appropriate dermatome area, ≤20% strength loss, and limitation of lower back movements. Since TFI is less effective in patients with advanced neural compression, such as extruded disc herniation, it was not applied to patients with advanced neural compression and >20% newly developed muscle strength loss (10,15,20). Radiological findings at the level of laminectomy defect in lumbar MRI showed RLDH, epidural fibrosis, osteophyte formation of the vertebral corpus, facet joint degeneration and micro-instability. Patients who could not undergo clinical follow-up, patients with very large disc herniation, a central canal diameter <6 mm, spondylolisthesis more than grade I, severe instability on dynamic lumbar lateral radiographs, and history of vascular stent within 6 months; patients who could not complete the procedure because of respiratory distress in the prone position (patients with lung problems, such as chronic obstructive pulmonary disease); those who were known to have a hypersensitivity reaction to the local anesthetic and steroid; and pregnant patients were excluded from the study.

The patients were grouped into RLDs and ODVP (epidural fibrosis, micro-instability, lateral recess stenosis, central canal stenosis) according to MRIs. Radiofrequency thermo-ablation (RFT) was performed on the facet joints of all patients. Patients in both groups were divided into two subgroups as those who received TFI and those who received TFI + CI. Routinely performing facet denervation in patients aims to control LBP originating from the facet joint, apart from LDHs. This also contributed to the standardization of patients in the study. CI was performed in patients with multiple LDHs without radicular pressure on MRI, except at the lumbar level where they had undergone lumbar disc herniation surgery (LDHS). Combined treatment was performed to apply the treatment that would relieve the patients' low back and leg pain in the best way possible. Pain status was assessed using the Oswestry Disability Index (ODI) and leg visual analog scale (VAS) before and 1 h after the procedure. Six months after the procedure, patients were called by telephone, and their final status was evaluated with the ODI and leg VAS. Patients whose complaints improved after pain treatment procedures and who did not require surgical treatment during the follow-up were called again after 14–16 months, and the state of well-being was determined using ODI and VAS. Patients with <50% pain complaints at the 6th month and 1st year postoperatively were recorded. For phone interviews, a patient

list including patient name-surname, identity number of the Republic of Turkey, phone number, date of surgery, date of interventional pain treatment, and preintervention complaints was created. Phone calls were made by the newly recruited resident physician who did not know the patients and did not have detailed information about the procedures.

Informed consent was obtained from the patient and his relatives about the procedure to be applied and the use of data before the interventional pain treatment.

A single-dose 1 g cefazolin was administered to the patients 30 min before the procedure. The patients were placed on the operating table in a neutral position prone on a silicone gel roll. A local anesthetic injection containing 80 mL of lidocaine, 0.05 mg epinephrine, and 50 mg of bupivacaine was administered under the skin and deep fascia 5 min before the procedure. Facet RFT was applied first, followed by TFI and KE, respectively. RFT was applied for 60 s at 80°. Moreover, 10 mg bupivacaine (2 ml), 20 mg methylprednisolone (0.5 mL), and 0.9% isotonic sodium chloride solution (2.5 mL) combination for TFI and 40 mg bupivacaine (8 mL), 80 mg methylprednisolone (2 mL), and 0.9% isotonic sodium chloride solution (10 mL) combination for KE were applied. Iohexol 300 mg/50 mL was used as a radiopaque substance to determine the appropriate injection site in EIs. Moreover, 3 mL of radiopaque fluid was used in TFI and 5 mL in CI. TFI and KE procedures were performed with Brauna© 22 gage (G), 90/120 mm Spinocan. Radiofrequency procedure was performed with TOP© 21 G, 100 mm, 10 mm active cap, Neuropole Needle. Preganglionic epidural injection was performed via the subarticular route in the transforaminal procedure, and epidural injection was performed through the sacral hiatus in the caudal intervention. All procedures were performed under fluoroscopy guidance. Since it is known that successful results were obtained after only one treatment attempt in 94% of patients who underwent TFI, a single injection was attempted in all patients (20). After the procedure, the patients were transferred to the hospital bed and discharged after approximately 1 h of service follow-up, with oral nonsteroidal anti-inflammatory drugs prescribed.

Table I: Female and Male Ratios and Age Distribution in Relapse and Pathologies Other than Relapse

	Relapsed LDH (n = 21)		Nonrelapsed LDH (n = 27)	
	Facet block and TFI (n=8)	Facet block, TFI and CE (n=13)	Facet block and TFI (n=18)	Facet block, TFI and CE (n=9)
Female	3	5	11	5
Male	5	8	7	4
Average age	47 (27–64)	44 (24–73)	48 (30–69)	50 (37–80)

Statistical Analyses

SPSS 25.0 (IBM Corporation, Armonk, NY) was used in the statistical analyses of the findings obtained in the study. Descriptive statistical methods (frequency, percentage, mean, standard deviation) were used to evaluate the study data in addition to Mann–Whitney U test and chi-squared test for the evaluation of normal distribution. The Mann–Whitney U test was used to compare the quantitative data between the two groups, the Wilcoxon sign test was used to compare whether there was a difference between the results of two measurements obtained from the same data source, and the Friedman test was used for measurements that were not in accordance with normal distribution. A p-value <0.05 was considered significant. Bonferroni correction was used to reduce the chances of obtaining false-positive results when multiple pair wise tests are performed on a single set of data.

RESULTS

The mean age of patients was 47.31 years (range, 24–80). There were 24 men (24–80 years; mean, 48.16 years) and 24 women (27–73 years; mean, 46.45 years) (age and female/male ratio, p=0.447 and p=0.140, respectively). Patients underwent LDS on an average of 66.41 months (1–300 months) before percutaneous interventions. There was no statistically significant difference in age (p=0.447) and sex (p=0.146) between both groups (Table I). In the radiological imaging of patients, 21 RDHs and 27 ODVP were detected (Table II).

FB and TFI were performed in 8 of RLDHs, and FB, TFI, and CI in 13. The mean age of those who underwent FB-TFI was 47 years (27–64), the F/M ratio was 3/5, the mean age of those who underwent FB-TFI-CI was 44 years (24–73), and the F/M ratio was 5/8. The mean age of the patients was 46 years (24–73), and the F/M ratio was 8/13. FB and TFI were performed in 18 of ODVP, and FB, TFI and CI were performed in 9. The mean age of those who underwent FB-TFI was 48 years

Table II: Patient Characteristics and Comparison of Demographic Data

+ (n = 21)		Recurrence Ø (n=27)		p
Age *mean* ± SD (min–max)		45.52 ± 13.98 (24–73)	48.79 ± 12.48 (30–80)	[1]**0.447**
F/M n	**Female**	8	16	[2]**0.146**
	Male	13	11	

[1]Mann–Whitney U test, [2]Chi-squared test, ***n:*** *Number of patients,* ***SD:*** *Standard deviation.*

(30–69), the F/M ratio was 11/7, the mean age of those who underwent FB-TFI-CI was 50 years (37–80), and the F/M ratio was 5/4. The mean age of patients was 47.8 years (30–80), and the F/M ratio was 16/11. There was no statistically significant difference in age (p=0.447) and sex (p=0.146) between both groups (Table I).

Neurological examination results of the patients were followed closely by administering interventional pain treatments in the operating room environment under local anesthesia, and no permanent neurological deficits or major complications developed in the patients. However, severe pain was observed during the procedures in some patients. Nevertheless, none of the patients required discontinuation of interventional pain therapy.

The VAS and ODI scores of patients with RLDH who underwent FB-TFI were 8.62 and 42.62 preoperatively, 5.25 and 27.25 at 1 h postoperatively, and 4.33 and 25.42 at 6 months postoperatively, respectively. The VAS and ODI scores of patients with RLDH who underwent FB-TFI-CI were 8.61 and 42.84 preoperatively, 5 and 27.76 at 1 h postoperatively, and 4.88 and 28.22 at 6 months postoperatively, respectively (Table III).

The VAS and ODI scores of patients with ODVP who underwent FB-TFI were 8.55 and 44.5 preoperatively, 3.33 and 21.05 at 1 h postoperatively, and 4.11 and 24.11 at 6 months postoperatively, respectively. The VAS and ODI scores of patients with ODVP who underwent FB-TFI-CI were 8.55 and 41.55 preoperatively, 3.44 and 20 at 1 h postoperatively, 4.11 and 23 at 6 months postoperatively, respectively (Table III). In the follow-ups after interventional pain treatment, the ODI and VAS scores remained at a lower level compared to those preoperatively, and statistically significant improvement continued in the 6th month controls of patients with RLDH and ODVP who did not require surgery (p≤0.05) (Tables IV, V). When the FB and TFI groups of these patients were compared with the groups treated with FB, TFI and CI, no statistically significant difference was found in the ODI and VAS scores at 6 months (p≥0.05) (Table VI).

Among the patients with RLDH, 2 of 8 patients who underwent FB and TFI and 4 of 13 patients who underwent FB, TFI, and CI were operated within 6 months after the procedure. While 1 of 18 patients who underwent FB and TFI due to pathologies other than RLDH required surgical treatment within 6 months, no patient in the other group underwent surgical treatment. The numbers of patients whose complaints had decreased 50% and more than six months and 1 year in the RLDH group that underwent FB and TFI were 4/8 (50%) and 3/8 (37.5%), respectively, and in those who underwent FB, TFI and CI were 7/9 (77.7%) and 4/9 (44.4%), respectively. The success rates in patients treated the FB and TFI groups that applied to those with pathologies other than relapse were 11/18 (61.1%) and 8/18 (44.4%), respectively, and in those treated with FB, TFI, and CE were 7/9 (77.7%) and 4/9 (44.4%), respectively (Table VII, VIII).

The comparison between the reduction in pain level in the first hour after pain management procedures and continuation of well-being was investigated in all patients who had an operative history. In 85% (17/20) of patients whose pain level decreased by 71% or more according to the VAS scores measured at 1 hour after pain treatment, the benefit was sustained for 1 year or longer. These findings were statistically significant (p≤0.001).

DISCUSSION

RLDHs and previously mentioned other pathologies response to the interventional pain treatment are different, which are the cause of recurrent LBP and leg pain after LDH surgery (17). There is no consensus on how to treat patients who underwent LDH surgery when similar complaints reappear. In clinical practice, most of the time, the treatments are administered based on clinical habits and experience relating to surgical or conservative treatments. At this point, these patients often do not have neurological deficit and that the purpose of treatment is to relieve pain. In the literature, the rate of complaints of low back and leg pain in the short-term (2 years ago) is 3%–34%, and the rate of similar complaints in the long-term (2 years later) is 5%–36% (26,33). At this point of view, starting from

Table III: VAS and ODI Scores Before, After, and 6 Months After Interventional Pain Treatment

		Relapsed LDH (n=21)		Nonrelapsed LDH (n=27)	
		Facet block and TFI ($^{\delta}$n=8)	Facet block, TFI and CE ($^{\delta}$n=13)	Facet block and TFI ($^{\delta}$n=18)	Facet block, TFI and CE (n=9)
Preop	VAS	8.62 (8–9)	8.61 (8–9)	8.55 (7–9)	8.55 (7–9)
	ODI	42.62 (34–50)	42.84 (34–52)	44.5 (34–58)	41.55 (34–52)
Postop	VAS	5.25 (0–9)	5.0 (0–9)	3.33 (0–9)	3.44 (1–9)
	ODI	27.25 (10–46)	27.76 (11–42)	21.05 (6–58)	20 (10-40)
Six months postop	VAS	4.33 (1–9)$^{\delta}$	4.88 (1–9)$^{\delta}$	4.11 (0–9)$^{\delta}$	4.11 (1–9)
	ODI	25.42 (12–46)$^{\delta}$	28.22 (13–42)$^{\delta}$	24.11 (6–58)$^{\delta}$	23.00 (12–46)

$^{\delta}$Groups with patients who underwent operation in the follow-ups after interventional pain treatment.

Table IV: Baseline and Postprocedure Comparison of Oswestry Disability Index Scores Between the Groups

	Recurrence		p[1]
	+ (n=21)	Ø (n=27)	
Baseline ODI $_{mean±SD\ (min–max)}$	42.76 ± 4.74 (34–52)	43.52 ± 6.11 (34–58)	0.867
After the procedure			
1st hour ODI $_{mean±SD\ (min–max)}$	27.57 ± 12.86 (10–46)	20.70 ± 15.14 (6–58)	0.055
6th month ODI $_{mean±SD\ (min–max)}$	34.52 ± 12.40 (12–50)	33.81 ± 17.24 (10–69)	0.892
P-value [2]	<0.001*	<0.001*	
P-values between pairwise [3]			
Baseline vs. 1st hour	0.002**	<0.001**	
Baseline vs. 6th month	0.012**	0.009**	
1st hour vs. 6th month	0.006**	<0.001**	

Data presented as mean ± standard deviation (min–max). [1] Mann–Whitney U test [2]Friedman test [3]Wilcoxon signed-rank test
***ODI:** Oswestry Disability Index. *Statistically significant (p<0.05); **Statistically significant (p<0.05/3 = 0.017) [according to Bonferroni correction]*

Table V: Baseline and Postprocedure Comparison of Visual Analogue Scale Scores Between the Groups

	Recurrence		
	+ (n=21)	Ø (n=27)	P-value[1]
Baseline VAS $_{mean\ ±\ SD\ (min–max)}$	8.75 ± 0.45 (8–9)	8.58 ± 0.64 (7–9)	0.902
After the procedure			
1st hour VAS $_{mean\ ±\ SD\ (min–max)}$	4.56 ± 3.52 (0–9)	3.46 ± 2.97 (0–9)	0.136
6th month VAS $_{mean\ ±\ SD\ (min–max)}$	6.5 ± 8.03 (1–10)	4.12 ± 3.33 (0–9)	0.462
P-value [2]	<0.001*	<0.001*	
P-values between pairwise			
Baseline vs. 1st hour	0.002**	<0.001**	
Baseline vs. 6th month	0.049	<0.001**	
1st hour vs. 6th month	0.058	0.035	

Data presented as mean± standard deviation (min–max). [1] Mann–Whitney U test [2]Friedman test [3] Wilcoxon signed-rank test
***VAS:** Visual analogue scale. * Statistically significant (p<0.05); ** Statistically significant (p<0.05/3=0.017) [according to Bonferroni correction].*

Table VI: Statistical Table of VAS and ODI Scores in Relapse and Nonrelapse Pathologies

	FB-TFI-CI (n)	FB-TFI (n)	p
ODI			
Relapse	9	16	0.284
Nonrelapse	7	10	1.000
VAS			
Relapse	8	9	0.248
Nonrelapse	13	15	0.386

the most conservative treatment in the treatment of patients' pain to not perform unnecessary surgical interventions to the patients.

Surgical treatments of RLDs or other pathological conditions prementioned in the introduction have important complications, such as root injury, dural injury, increased fibrosis, and infections, and additional complications related to the general anesthesia (28). When complications related to TFIs are examined, spinal cord infarction has been reported in case reports (11,16,34). In the study reported of 14,956 TFIs' side effects, no complications that could cause serious damage, such as hematoma, infection, and permanent neurological injury, were reported, and minor and temporary complications, such as vagovagal reaction, flushing, headache, insomnia,

Table VII: Patients Amount Whose Complaints had been Decreased %50 and More on Six Months and more than 1 Year

	Recurrent LDH		ODVP	
	FB-TFI	**FB-TFI-CI**	**FB-TFI**	**FB-TFI-CI**
Six months	4/8 (50%)	7/9 (77.7%)	11/18 (61.1%)	7/9 (77.7%)
>1 year	3/8 (37.5%)	4/9 (44.4%)	8/18 (44.4%)	4/9 (44.4%)

Table VIII: Comparison of the Pain Rates in the Postoperative 1st Hour After the Procedure and the Duration

	Well-being period	
The rate of pain reduction at postoperative 1st hour	**1 year (19)**	**6 month (8)**
71%–100% (n=20)	17 (89%)	1 (12.5%)
70%–61%	1 (5.5%)	2 (25%)
60%–51%	1 (5.5%)	4 (50%)
50%–41%	-	1 (12.5%)
40%–31%	-	-

allergic reaction, changes in blood glucose level, and temporary increased weakness, were presented (6). In our study, no major life-threatening or neurological complications that cause permanent neurological deficits were observed in the patients.

Studies showed that TFIs applied to patients with primary LDH prevent the need for surgery (21,31). Although there is no such study on RLDHs, EIs may be effective in avoiding a new surgical treatment as much as possible for low back and leg pain after LDS and, in a sense, minimizing the risk of failure of back surgery. Since the patients included in the study had lower back pain in addition to leg pain, we also applied RFT in addition to EIs. The effectiveness of RFT has been demonstrated especially in LBP originating from the facet joint (4,6,18). However, corticosteroid injection into the facet joint was not performed with RFT, since it was shown that steroid injection together with RFT did not prevent neuritis formation after neurotomy and did not contribute to long-term results (1,30). The fact that facet RFT was performed on all patients also contributed to the standardization of the study. Moreover, in the study of Wei et al., the combined application of TFI and RFT had better long-term effectiveness and patient satisfaction, and that the recurrence rate was lower than the application of TFI alone (37).

In the study conducted by Klessinger, the success rate of TFI in ODVPs was 43%, and the relapse rate was 26.8%. It was stated that TFI may be effective in ODVPs, but the success rates in relapses should be further investigated (17). In our study, the success rate of TFI and FB performed in RLDHs were 50% in the 6th month, and 37.5% in the first year, while the success rate in ODVPs were 61.1% in the 6th month, and 44.4% in the first year. Although the steroid dose administered per level in the same study was 10 mg of triamcinolone, the administration of 20 mg of methylprednisolone per level may explain the higher success rates in our study. Apart from that, when the success rates in RLDHs and ODVPs were compared in our study, similarly better results were obtained (17). The study of Karamouzian et al., revealed that TFI and CI were successful in pain relief in recurrent disc hernias by approximately 40%, and there was no statistical difference between TFI and CI (14). They also emphasized that they could not achieve a high success rate in relapses (14). On the other hand, Evran et al. suggested that when patients who underwent TFI with TFI and CI were compared, those who underwent TFI and CI in RLDHs were statistically significantly better at the 3rd week, 3rd month, and 6th mo controls. It has been emphasized that the combined application of TFI and KE is more effective in RLDHs (7). In our study, no significant difference was found between the ODI and VAS scores of the patients in both groups who underwent FB+TFI and those who underwent FB+TFI+CI. We performed CI in patients with multiple disc herniation and in both groups. However, we did not see any particular difference to the CI in addition to the TFI. Thus, we suggested that EIs are more effective in ODVPs, and the rate of patients who need to surgical treatment is low.

When there was reduction in pain levels of ≥71% within the first h after the procedure in pain treatment applied to relapse and ODVPs, it has been determined that 85% of the cases remained well for more than 1 year. In the current literature, there isn't any study showed the relationship between reduction in pain level and maintenance of well-being. Additionally, in studies on EIs that were applied to RLDHs, there is no standard practice regarding the type and dose of steroids and local anesthetics (23,29). Moreover, although there are placebo studies on lumbar disc hernias that applied TFI, the lack of comparison with placebo in TFI studies on RLDHs raises doubts about steroid injection (35). Although the results are worse in RLDHs compared to other pathologies, since the long-term (>2 years) follow-up results cannot be evaluated, the benefits arising from the long-term effects of the injections cannot be evaluated, so it may not be appropriate to decide on the effectiveness by looking at the short-term results. To evaluate this, it was suggested that it would be beneficial to conduct studies with a long follow-up period. Another important point is that the power balances differ among the lumbar disc levels of the spine, which is a biomechanical structure (38). Since the biomechanical properties of the injected levels differ within themselves, perhaps evaluating the TFIs according to the levels may contribute to the formation of more accurate results.

Considering the biochemical properties of steroids and their effects on cells, it is a predictable fact that it will be effective when applied to the epidural area (12,32). However, to evaluate its effects in primary, relapse, and other pathologies, controlled studies with standard drug dose and type specific to patient groups and long follow-up periods are needed.

Although there are many articles in the literature about palliative pain procedures applied in spinal problems, there is almost no study on this subject in patient groups who have undergone LDS and whose pain complaints continue or recur. Although this study was conducted retrospectively and in a relatively small group of patients, we suggest that it is important in terms of the results obtained.

CONCLUSION

Interventional pain treatments were generally beneficial in patients with low back and leg pain after LDH surgery. We did not detect any differences in the aspect of effectiveness of pain procedures between recurrent disc herniation and other pathologies. We also determined that adding CI to the treatment protocol did not change the outcomes of pain management. However, considering the number of groups formed in the study, it would be appropriate to conduct the study with a larger patient series to obtain more reliable results.

AUTHORSHIP CONTRIBUTION

Study conception and design: FD, SK, EC

Data collection: FD

Analysis and interpretation of results: FD, OO, YBO, SK, EC

Draft manuscript preparation: FD, OO, YBO, SK, EC

Critical revision of the article: FD, OO, YBO, SK, EC

Other (study supervision, fundings, materials, etc...): FD, OO, OB, YBO, SK, EC

All authors (FD, OO, OB, YBO, SK, EC) reviewed the results and approved the final version of the manuscript.

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