Agri 2021;33(4):253–260
doi: 10.14744/agri.2021.43403

ORIGINAL ARTICLE

Effectiveness of interventional procedures for post-laminectomy syndrome: A retrospective study

Kliniğimizde Postlaminektomi sendromu tanılı hastalarda yapılan girişimsel işlemlerin tedavi etkinliğinin retrospektif olarak araştırılması

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Summary

Objectives: In our study, we aimed to evaluate the change in numerical rating scale (NRS) score and interventional procedures performed on patients with post-laminectomy syndrome whose NRS score 7 and above according to the NRS.

Methods: This study was carried out by examining the files of 107 patients, including 69 women and 38 men, aged 18 years and over who had applied between February 1, 2010, and February 1, 2015. Pain localization, post-operative periods, interventional procedures, and post-procedural pain status were determined using pain monitoring forms and hospital automation system in our clinic. Statistical significance of the obtained data was evaluated by Pearson Chi-square test, Kruskal–Wallis H test, Friedman test, and Mann–Whitney U-test. p>0.05 was not statistically significant, p<0.05 was considered statistically significant.

Results: With interventional procedures, 48.5% of patients had a reduction in pain of more than 50%. The success rate was 66.7% in patients with radicular pain. Pain palliation was achieved in 28.8% of patients who underwent transforaminal epidural steroid injection, whereas in patients undergoing dorsal root ganglion pulsed radiofrequency, this rate was 44.4%. When the pain scores of patients with permanent spinal cord stimulator (SCS) were compared with other patient groups, permanent SCS was found to be statistically and clinically significant (p<0.001).

Conclusion: Post-laminectomy syndrome is not usually caused by a single pathology, and more than 1 intervention and recurrence are often needed. Post-laminectomy syndrome is a disease that requires a multidisciplinary approach and multiple treatment options must be decided according to the patient. More research is needed on treatment options.

Keywords: Interventional treatments; post-laminectomy syndrome; spinal cord stimulator.

Özet

Amaç: Çalışmamızda Postlaminektomi sendromu tanısı almış, ağrısı sayısal derecelendirme ölçeğine (SDÖ) göre 7 ve üzeri hastalara uygulanan girişimsel işlemleri; işlem sonrası SDÖ puanındaki değişimin değerlendirilmesini amaçladık.

Gereç ve Yöntem: Bu çalışma, 01.02.2010-01.02.2015 tarihleri arasında başvurusu bulunan ve girişimsel işlem yapılan 18 yaş ve üzerindeki 69 kadın, 38 erkek olmak üzere 107 hastanın dosyalarının incelenmesi ile gerçekleştirildi. Polikliniğimizde bulunan ağrı takip formları ve hastane otomasyon sistemi kullanılarak, hastaların ağrı lokalizasyonu, postoperatif süreleri, yapılan girişimsel işlemler ve işlem sonrası ağrı durumları tesbit edildi. Elde edilen verilerin istatistiksel anlamlılığı Pearson Ki-Kare testi, Kruskal Wallis H testi, Friedman ve Mann Whitney U testleri ile değerlendirildi. P>0.05 anlamsız, p<0.05 anlamlı kabul edildi.

Bulgular: Girişimsel işlemler ile hastaların %48,5'inde, %50'den fazla ağrıda azalma tesbit edilmiştir. Radiküler karekterde ağrısı bulunan hastalarda başarı oranı %66,7 olarak tesbit edilmiştir. Transforaminal epidural steroid enjeksiyonu uygulanan hastaların %28,8'inde ağrı palyasyonu sağlanırken, dorsal root ganglion pulsed radyofrekans işlemi uygulanan hastalarda bu oran %44,4 olarak tesbit edilmiştir. Kalıcı Spinal kord stimülatörü (SKS) takılan hastaların ağrı puanları diğer hasta grupları ile karşılaştırıldığında ise kalıcı SKS, hem istatistiksel hem de klinik olarak anlamlı derece etkin bulunmuştur (p<0,001).

Sonuç: Postlaminektomi sendromu çoğu zaman tek bir patolojiden kaynaklanmaz ve çoğu zaman birden fazla girişime ve tekrara ihtiyaç duyulur. Postlaminektomi sendromu multisidipliner yaklaşım gerektiren ve çoklu tedavi seçeneklerinin hastaya göre karar verilerek uygulanmasını zorunlu kılan bir hastalıktır. Tedavi seçenekleri ile ilgili daha fazla çalışmaya ihtiyaç vardır.

Anahtar sözcükler: Girişimsel tedaviler; postlaminektomi sendromu; spinal kord stimülatörü.

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Submitted *(Başvuru tarihi)* **31.08.2020 Accepted after revision** *(Düzeltme sonrası kabul tarihi)* **10.01.2021 Available online date** *(Online yayımlanma tarihi)* **27.08.2021**

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Introduction

Chronic low back pain and sciatica after spinal surgery are termed for post-laminectomy syndrome.[1] Even though pain and loss of function after cervical spinal surgery are also described as post-laminectomy syndrome, it is mostly reported after lumbar surgery.[2] It is known that the higher number of spinal operations can lead to higher rate of failed back surgery. Success rate after a single lumbar operation is 50%, while the success rate in patients operated 4 times decreases to 5%.[3]

The etiology of post-laminectomy syndrome can be examined in two groups as factors related to the patient and surgical procedure. Patient diagnoses such as anxiety, depression, somatization disorder, and poor management of pre-operative pain reduce the rate of surgical success.[4] Insufficient decompression or the opposite aggressive surgical approaches are both included in the etiology of post-laminectomy syndrome. Incorrect placement of the graft or screw can cause nerve damage and adhesions and lead to post-operative radicular and neuropathic pain.[5] Continuing root pressure after lumbar surgery is one of the common causes of residual symptoms. Surgery performed at the improper level and insufficient amount of bone, disc or ligament removed can result in instability and neurological pressure caused by post-operative vertebral corpus listhesis and facet deficiency. Regardless of the amount removed, the development of insufficiency in the facet joint after the operation can result in spinal instability. Disc hernia may occur at another level as a result of imbalance in load distribution after surgery. In patients diagnosed with spondylolisthesis, there is a high probability of developing spinal stenosis after decompression or spinal stabilization. Complications such as post-operative hematoma development and infection can also cause pain.[2]

Treatment of post-laminectomy syndrome should target the pain generator. Surgical option should not be prioritized in the treatment due to high morbidity and low success rate.

Interventional procedures are among the treatment options in patients whose conservative approach does not provide sufficient results. Interventional treatments planned according to area and causes of pain include epidural/transforaminal steroid injection (TFSI), facet median nerve (FMN) and sacroiliac joint (SIJ) radiofrequency thermocoagulation (RFT), and dorsal root ganglion pulse radiofrequency (DRG PRF).

In the present study, the propagation of pain in patients who underwent interventional procedures due to post-laminectomy syndrome, which procedures were performed and at what frequency, the effects of the procedures and their duration of impact were retrospectively evaluated on a procedural basis and compared.

Material and Methods

This study was approved by the Osmangazi University, Non-Interventional Clinical Research Ethics Committe (date: 10.08.2016, number: 25). Patients aged ≥18 years, who applied to the Algology Outpatient Clinic of ESOGÜ Medical Faculty Hospital and diagnosed with post-laminectomy syndrome between February 1, 2010, and February 1, 2015, were retrospectively screened using the hospital's electronic database and pain tracking forms available in our clinic. Patients with a pain score of 7 and above according to the numerical rating scale (NRS) and patients who had undergone at least one of the interventional treatment options were included in the study. Patients <18 years of age, patients with inflammatory or oncological pain, patients with radiologically detected segmental instability, and patients who did not receive interventional treatment were excluded from the study.

Patients' age, gender, comorbidities, number of previous low back surgery and post-operative duration, the location and extent of pain during admission to our outpatient clinic, and pain score out of 10 according to the NRS (0–10; 0: No pain and 10: Unbearable pain), pain medications used, procedures performed in our outpatient clinic, NRS score during follow-up in 15 days, 3 months, and 1 year after the initial procedure, and the presence of neuropathic pain were recorded from pain forms and hospital database.

Patients' follow-up NRS scores 15 days and 3 months after the procedure and the initial NRS scores recorded during admission were compared. Interventional operations were divided into groups and the change between the admission and the last follow-

Table 1. Patient data before interventional procedure

	Minimum	Maximum	Mean	Standard deviation
Age	25th	76	53.23	12.89
Time after previous lumbar operation (month)	1st	144	44.33	34.04
Number of previous lumbar operations	1st	5th	1.51	0.81
First application NRS score	6th	10th	8.21	0.58

NRS: Numerical rating scale.

up NRS scores were compared. Patients were divided into groups according to pain localizations (lumbar/waist and radiation to lower extremities), and the effectiveness of interventional procedures was compared.

Statistical analysis

Statistical Package for the Social Sciences for Windows 21.0 was used for statistical analysis. Mean, standard deviation, median, and minimum-maximum values were used when presenting descriptive analyses. Pearson Chi-square and Fisher's exact tests were used for 2 × 2 comparisons. Normality was examined by histogram graphs and Kolmogorov–Smirnov test. Independent samples t-test was used for evaluating normally distributed (parametric) variables between independent groups, and Mann–Whitney U-test was used for evaluating non-normally distributed (non-parametric) variables. Kruskal–Wallis test and Friedman test were used when evaluating variables between more than 2 groups and not normally distributed. The results were evaluated at 95% confidence interval, at a significance level of $p<0.05$ and $p<0.001$.

Results

One hundred and seven patients aged 18 and older who were diagnosed with post-laminectomy syndrome and underwent interventional procedures were included in the study. Sixty-nine (64.5%) of the patients were female and 38 (35.5%) were male. Patient data before the interventional procedure are shown in Table 1.

Pain localizations of patients were examined in three groups: Lumbar-hip pain, lumbar-hip pain radiating to the extremities, and only extremity pain. About 22.4% of patients had lumbar-hip pain, 72% had lumbar-hip pain radiating to the lower extremities. The ratio of patients with isolated lower extremity pain was 5.6%. Neuropathic pain was detected in 47 patients (43.9%).

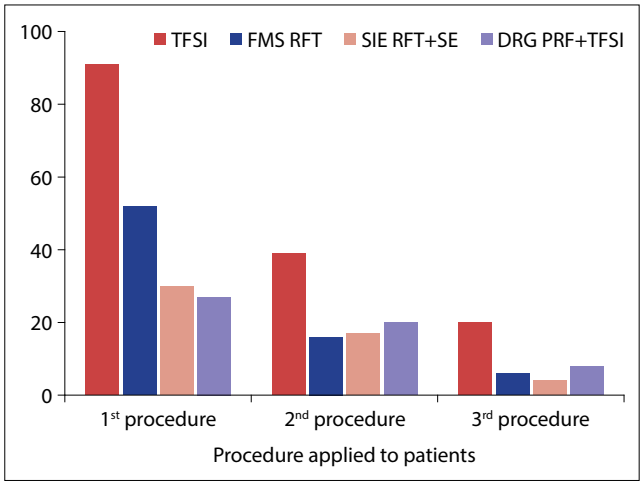

Figure 1. Interventional procedures performed.

RFT: Radiofrequency thermocoagulation; PRF: Pulse radiofrequency; SE: Steroid injection; SIE: Sacroiliac joint; FMS: Facet median nerve; DRG: Dorsal root ganglion; TFSI: Transforaminal steroid injection. 1st Intervention/2nd Intervention/3rd Intervention.

Interventional procedures

The number of first interventional procedures applied to patients was 200. Fifty-four patients (50.4%) underwent interventional procedures for the 2nd time and the number of procedures was 92. The number of patients undergoing a third interventional procedure was 21. The number of procedures performed was 38 (Fig. 1).

Spinal cord stimulation (SCS) was applied as the first procedure to a patient who had previously received epiduroscopy once and epidural steroid injection (SI) twice in an external center before applying to our outpatient clinic, but was referred to our clinic due to persistent pain.

Post-procedure pain conditions of patients

When the results were evaluated according to the procedures performed or according to the localiza-

Table 2. Procedures performed and pain scores of patients with lumbar-hip pain radiating to the lower extremities

Lumbar-hip pain radiating to the lower extremities	Median	25	75	P	Multiple comparisons
SIE RFT+SI				<0.001	1–2, 1–3
Initial NRS	8.00	8.00	8.00		
15th day follow-up NRS	4.00	2.00	4.00		
3rd month follow-up NRS	6.00	3.00	8.00		
FMS RFT				<0.001	1–2, 1–3, 2–3
Initial NRS	8.00	8.00	8.00		
15th day follow-up NRS	4.00	2.00	4.75		
3rd month follow-up NRS	6.00	4.00	8.00		
TFSI				<0.001	1–2, 1–3, 2–3
Initial NRS	8.00	8.00	8.50		
15th day follow-up NRS	4.00	3.00	4.00		
3rd month follow-up NRS	6.00	4.00	8.00		
DRG PRF+TFSI				<0.001	1–2, 1–3
Initial NRS	8.00	8.00	8.00		
15th day follow-up NRS	4.00	2.25	5.75		
3rd month follow-up NRS	4.50	3.25	8.00		

Friedman repeated measures analysis of variance on ranks; NRS: Numerical rating scale; RFT: Radiofrequency thermocoagulation; PRF: Pulse radiofrequency; SI: Steroid injection; SIE: Sacroiliac joint; FMN: Facet median nerve; DRG: Dorsal root ganglion; TFSI: Transforaminal steroid injection.

tion of pain, there was a significant decrease in the 15th day follow-up and 3rd month follow-up NRS scores compared to the NRS scores at admission (p<0.001). Largest pain reduction at the 3rd month follow-up was recorded in patients who underwent DRG PRF + TFSI. However, no procedure could provide a 50% pain reduction after 3 months (Table 2).

Distribution of patients with more than 50% reduction in pain

The distribution of patients with more than 50% reduction in pain based on post-operative NRS according to pain localization is shown in Table 3.

Of the 77 patients with lumbar-hip pain radiating to lower extremities, 45 underwent TFSI and 50% reduction in pain (therapeutically significant) was detected at the 15th day and 3rd month follow-up compared to baseline. More than 50% pain palliation was achieved 3 months after the procedure in 28.8% of patients who underwent TFSI. The distribution of patients with more than 50% reduction in pain according to the procedures is shown in Table 4.

More than 50% reduction in pain was achieved in 26 (55.3%) of 47 patients with neuropathic pain.

Table 3. Distribution of patients with more than 50% reduction in pain according to pain localization

Pain localization/number	n	%
Lumbar-hip pain only/24 patients	15th	62.5
Extremity pain only/6 patients	4th	66.7
Lumbar-hip pain radiating to lower extremity/77 patients	43rd	55.8

Data of patients implanted with a SCS

The number of patients implanted with a SCS was 9. After 1 year of follow-up, it was found that the SCS of one of the patients was removed due to lack of benefit.

There was a statistically significant difference between admission and last follow-up NRS scores of patients implanted with SCS (p=0.007) (p<0.05) (Table 5).

When patients with SCS and patients who underwent other interventional procedures were compared, NRS scores were significantly lower in patients with SCS (p<0.001) (Table 6).

Table 4. Initial procedures performed on patients with more than 50% reduction in pain

Initial procedure/total number	n	%
SIE RFT+SE/30	10th	33.3
FMS RFT/52	18th	34.6
TFSI/91	33rd	36.2
DRG PRF/27	12th	44.4

RFT: Radiofrequency thermocoagulation; PRF: Pulse radiofrequency; SE: Steroid injection; SIE: Sacroiliac joint; FMN: Facet median nerve; DRG: Dorsal root ganglion; TFSI: Transforaminal steroid injection.

Table 5. Admission and last follow-up NRS SCORES of patients with SCS

	Median	25%	75%	p
Initial NRS	9000	8000	9000	0.007
Last follow-up NRS	2.00	1.50	3.00	

Wilcoxon signed-ranks test; NRS: Numerical rating scale; SCS: Spinal cord stimulation.

Table 6. Last follow-up NRS scores of patients with and without SCS

SCS	Mean	25%	75%	p
Last follow-up NRS				<0.001
No	4.00	3.75	6.00	
Yes	2.00	1.50	3.00	

Mann–Whitney U-test; NRS: Numerical rating scale; SCS: Spinal cord stimulation.

Discussion

The number of lumbar surgeries has increased in recent years. In the United States, there are 7 million new chronic back pain patients every year, and nearly 200,000 of these undergo lumbar spinal surgery.[6] In a study in which patients were followed up between 10 and 22 years after discectomy, it was found that 74.6% of patients had back pain complaints and 12% had back surgery.[7] Taking into account the increased number of operations, it can be predicted that the incidence of post-laminectomy syndrome will also increase. In a series of 182 cases diagnosed with post-laminectomy syndrome that they reoperated after classical laminectomy and discectomy, Fritsch and Rupp[7] reported that they detected recurrent disc herniation in 62% of cases, disc herniation at another level in 23% of cases, instability in 12% of cases, and fibrosis in 5% of cases. In their study, Burton et al.[8] reported spinal stenosis in 58%, recurrent disc herniation in 12%, and fibrosis in 8% of cases. As seen in different studies, etiological factors vary.

In some studies in which patients with mechanical back pain were evaluated, it was found that the incidence in women was higher than men.[9,10] In the present study, 64.5% (69 patients) of 107 patients diagnosed with post-laminectomy syndrome were female and 35.5% (38 patients) were male. In the multicentric study of Lee et al.[11] evaluating 120 patients with post-laminectomy, 60% of the patients were male and 40% were women and the mean age was 41.9 (±11.7). In the present study, the mean age was 53.2 (±12.8).

Pain localizations in post-laminectomy syndrome are presented in the form of lumbar-hip pain and pain radiating to the lower extremities; neuropathic pain may also occur due to neural damage that may occur during or after surgery.[12] In a study that evaluated 479 patients who underwent lumbar discectomy, it was found that radicular pain persisted in 14% of patients after the operation, and isolated lumbar-hip pain persisted in 25% of patients.[13] In the present study, lower back and hip pain was detected in 22.4% of patients and lumbar-hip pain radiating to the lower extremities was detected in 72% of the patients. The rate of patients with isolated lower extremity pain was 5.6%. Neuropathic pain was detected in 43.9% of patients.

Klessinger[13] found that pain was caused by facet joints in 7% of patients diagnosed with post-laminectomy syndrome and 58.8% of these patients were successfully treated with radiofrequency neurotomy. In this study, RF neurotomy technique was applied to FMN at 80° and percutaneous thermocoagulation was performed for 60 s. In our clinic, FMS RFT operation was performed with 70° 90 s percutaneous RF technique after localization with fluoroscopy and neurostimulator aid. FMS RFT was performed in 70.8% of patients with isolated lumbar-hip pain. Unlike other studies in the literature, the present study reflects the rate of FMS RFT only among patients who have undergone the procedure and followed for at least 1 year. The ratios are, therefore, high. In the present study, 50% or more reduction in pain (therapeutically significant) was detected in the 15th day follow-up after the FMS RFT procedure,

and the reduction was statistically significant. In the 3rd month follow-up, the pain scores did not reach the clinically adequate therapeutic level. More than 50% reduction in pain after the procedure was detected in 34.6% of patients who underwent FMS RFT. In the study of Klessinger,[13] a diagnostic block was performed to FMN twice in patients with primary facet syndrome and RF neurotomy was performed on patients with response. This has made patient choice more selective and brought an increase in success rate. In another study evaluating patients with FMS RFT, 60% success rate was reported after FMS RFT procedure to patients who responded to the diagnostic block.[14] There are no tests or imaging methods in the literature that indicate that the source of pain is the facet joint and are accepted as the gold standard.[15] The reports on the incidence of facet joint pain are, therefore, variable (10–50%). Diagnostic block procedure is a test with high specificity but low sensitivity. Performing procedures only in patients who respond to the diagnostic block can increase the success rate, but can result in the diagnosis to be overlooked. A more accurate approach is the combination of clinical characteristics of the patient, imaging methods, and diagnostic blocks.

In a systematic review of 56 studies conducted by Hansen et al.,[16] a weak level of evidence was reached on the effectiveness of conventional and pulse RF applied to SIJ, and the level of evidence on cooled RF neurotomy was higher. In our clinic, SIJ RFT + SI procedure was performed with 42°C 4 min pulse RF after localization with neurostimulator followed by local anesthetics and SI. In our study, SIJ RFT + SI was applied to 50% of the patients with isolated lumbar-hip pain, and a 50% reduction in pain (therapeutically significant) was detected at 15 days after the procedure, and the difference was found to be statistically significant. At the 3rd month follow-up, a reduction of more than 50% in NRS score was found in only 33.3% of the patients. Ferrante et al.[17] reviewed 33 patients retrospectively and reported successful results in 36% of the patients in 6 months follow-up after SIJ RFT. There is no gold standard treatment method recommended for patients with SIJ induced pain. The success rates of SIJ RFT are highly heterogeneous in the literature. In the literature, it is emphasized that there is limited evidence for SIJ RFT procedure for SIJ-induced pain and further research is needed.[18]

DRG PRF was first performed in the 1980s as an alternative to surgical rhizotomy for the treatment of chronic low back pain. Surgical rhizotomy has provided great short-term benefits in palliation of many pain syndromes, but its long-term effectiveness was low due to severe side effects.[19–21] Abejón et al.[22] evaluated 54 patients who underwent DRG PRF, positive results were reported in patients with disc herniation and spinal stenosis, but the same effect could not be observed in patients diagnosed with post-laminectomy syndrome. In a prospective study conducted by Lee et al.,[23] efficacy of DRG PRF for persistent radicular pain due to disc herniation in patients who do not benefit from TFSI has been found to be the same as repeating TFSI. DRG PRF procedure has been found to be as beneficial as SI in the subacute period to avoid side effects that may occur with the repetition of SI in clinical situations such as uncontrolled diabetes.[24] In the present study, TFSI was applied to 45 patients with lumbar-hip pain radiating to the lower extremities, and more than 50% pain palliation was achieved 3 months after the procedure in 28.8% of the patients who underwent TFSI. In another study in which 69 patients diagnosed with post-laminectomy syndrome were evaluated retrospectively, the success rate was similarly 26.8%.[25]

In our clinic, DRG PRF was performed at 42°C with 4 min pulse RF method after localization with neurostimulator and TFSI was performed in the same session. In the present study, 50% reduction in pain was achieved at the 15th day follow-up in patients with pain lumbar-hip pain radiating to the lower extremities who underwent DRG PRF + TFSI procedure compared to the initial pain levels (therapeutically significant) and the difference was statistically significant. Although pain reduction did not reach the clinically adequate level, a statistically significant reduction in pain was detected 3 months after the procedure. DRG PRF was found to be more effective in pain palliation than SIE RFT, FMS RFT, and TFSI (Table 2). In a retrospective study conducted by Erdine,[26] DRG PRF's success rate was reported as 60%. In the literature, different results have been reported regarding the success rates of DRG PRF. In the present study, more than 50% reduction in pain was found in 44.4% of patients who underwent DRG PRF as the first procedure. This ratio indicates higher success compared to other procedures.

Post-laminectomy syndrome often refers to a group of patients with multiple pathological variations. The low success rate compared to other diseases that are presented with chronic back pain reflects the difficulty of treatment of post-laminectomy syndrome and the fact that multiple procedures and a multidisciplinary approach are often needed. There is no publication in the literature that compares the treatment of radicular pain and isolated midline pains statistically. However, given the data, it appears that palliation of radicular pain with interventional procedures and other traditional treatment methods is more successful than isolated lumbar and hip pains.[18,27,28] Similarly, in the present study, more than 50% pain palliation was achieved in 48.5% of all patients with post-laminectomy syndrome, and this ratio increased to 66.7% in the group of patients with radicular pain.

A total of nine patients diagnosed with post-laminectomy syndrome were implanted with permanent SCS on achieving success during the trial period. In one of the patients, SCS was removed at the end of 1 year due to no benefit. The other eight patients continue to use SCS. In an observational multicenter study conducted by Zucco et al.,[29] 80 patients with post-laminectomy syndrome and SCS with persistent pain radiating to the lower extremities were followed for 24 months. Increased quality of life and reduction of pain in patients were statistically significant. In a study where 395 patients implanted with SCS were compared to reoperated patients, the duration and cost of post-operative hospital stay and the complication rate in the first 90 days period were lower in the SCS group, and the SCS group was found to be cost effective compared to the other group over a 2-year follow-up period.[30] In a randomized controlled clinical study in which 72 patients were examined, patients diagnosed with post-laminectomy syndrome, who were implanted with SCS or underwent resurgical procedures were examined, and contrary to many studies in the literature, evidence level of SCS procedure was found to be "moderate."[31] In a prospective, randomized, and multicenter study in which 100 patients diagnosed with post-laminectomy syndrome were examined, 52 patients were implanted with a SCS in addition to traditional pain therapy procedures, 48 patients underwent only traditional pain treatment methods, and when the groups were compared, more than 50% better results were obtained in SCS patients.[32] Similarly, in the present study, NRS scores of patients with SCS were significantly reduced compared to the initial scores (p=0.007). When patients with and without SCS (patients undergoing medical and other invasive procedures) were compared, SCS was found to be significantly effective both statistically and clinically (p<0.001).

Conclusion

Based on the results of the present study, it was observed that interventional procedures were effective in the early period in post-laminectomy syndrome, but this effect decreased in the long term.

SCS procedure was determined to be most effective method for pain treatment in post-laminectomy syndrome with effective pain relief in all follow-up periods.

Ethical Board Approval: Ethics committee approval was obtained from Eskişehir Osmangazi University Faculty of Medicine Ethics Board, Patient Approval: This is a retrospective study (date: 10.08.2016, number: 25).

Authors' Contributions: Concept: Ümit Akkemik; design: Ümit Akkemik; data collection or processing: Ümit Akkemik and Meryem Onay; and analysis or interpretation: Ümit Akkemik and Mehmet Sacit Güleç.

Conflict-of-interest issues regarding the authorship or article: None declared.

Peer-rewiew: Externally peer-reviewed.

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