

Sequestrectomy or microdiscectomy in patients with lumbar disc herniation

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Abstract

Aim: Which microsurgical method can provide better outcomes for patients with lumbar disc herniation (LDH) is still unclear in the literature. In the present study, the aim was to retrospectively examine the efficacy of both lumbar sequestrectomy (LST) and lumbar microdiscectomy (LMD) in patients with LDH.

Material and Methods: Re-herniation rate of patients (n=48), operation and hospitalization durations were evaluated. Preoperative and postoperative low back pain and leg pain of patients were evaluated using the Visual Analogue Scale (VAS). Postoperative analgesic usage duration and duration for returning to daily life were also evaluated. The mean follow-up period is seven month.

Results: Postoperative complications and re-herniation rate in patients who underwent LMD and LST were similar. However, postoperative analgesic usage, operation, and hospitalization duration were lower in the LST group. In addition, the duration required for returning to daily life was lower in the LST group than that in the LMD group.

Conclusion: Postoperative analgesic usage period and duration required for returning to daily life were less in patients who underwent LST. However, the efficacy of these surgical techniques should be investigated with multi-center, randomized, double-blind clinical trials which also have larger series of participants with different races.

Keywords: Lumbar Disc Herniation; Microdiscectomy; Postoperative Analgesic Use; Sequestrectomy; Visual Analogue Scale.

INTRODUCTION

Lumbar disc herniation (LDH) causes symptoms such as intermittent low back pain, sciatica, or patients may have more serious neurological symptoms. Treatment target in such cases is to reduce pain and inflammation (1).

To provide appropriate treatment, patients are informed of the physical measures they can take to protect their back and advised to rest in bed for a while. Moreover, nonsteroidal anti-inflammatory drugs (NSAIDs) such as acetylsalicylic acid and acetaminophen can be prescribed. In the presence of severe radicular symptoms that do not respond to such NSAIDs, drugs containing corticosteroids may be prescribed for benefiting from their anti-inflammatory effects (2,3). In addition, vitamins-B, opioids, myorelaxants, tricyclic/tetracyclic antidepressants can be used as a treatment option, and anticonvulsant agents such as gabapentin or pregabalin can be prescribed for the treatment of neuropathic pain due to a lumbar herniated disc (4-6).

Superficial heat treatment methods such as hot packs, infrared heat and hydrotherapies, and superficial cold treatment methods such as cold packets, ice massages, cold sprays, or treatment methods such as therapeutic ultrasound, shortwave, and microwave diathermy can be recommended for the treatment of lumbar herniated disc (7,8).

Methods such as transcutaneous electrical nerve stimulation, which is reported to activate large diameter A alpha nerve fibers, and to reduce nociceptor impulse transmission, can also be applied for providing effective treatment (9). Similarly, lower laser therapies, which are reported to have an anti-inflammatory effect by reducing prostaglandin synthesis, are preferred as a treatment option (10).

However, in cases where indications of urgent surgery such as conus medullaris lesion, cauda equina syndrome, lower leg pain or progressive neurological deficits occur or in cases where pain, limitation of movement, paresthesia

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symptoms, neurogenic claudication, and increase in bladder-intestinal-sexual dysfunctions (11) that do not respond to conservative treatment exist, invasive procedures such as elective surgery can be performed.

The aim of surgery is to remove disc herniation for achieving decompression of the affected neural structure while preserving the nerve tissue without damaging normal anatomical structures as much as possible. LDH surgery can be performed using a camera, known as an endoscope, and as well as micro skin incisions. In some types of LDH, minimally invasive treatments such as radiofrequency ablation may be performed.

In addition, advanced technological products such as special surgical microscopes and microsurgical instruments, which are considered as the gold standard in current neurosurgery practice, can be used to visualize three dimensional and enlarged images of the herniated discs and tissues (12). Surgical operations such as microdiscectomy in which the postoperative pain can be reduced by making a minimal incision according to herniated disc distance and scraping less muscle tissue can be performed. With this surgical procedure, postoperative complications such as neural tissue damage can be decreased, and disc material can safely be removed.

In the present study, the aim was to compare the efficacy of lumbar microdiscectomy (LMD) and lumbar sequestrectomy (LST) in patients with LDH.

MATERIAL and METHODS

Study design and eligibility criteria

In this retrospective study, data used were retrieved from the archived medical records of patients diagnosed with a single level of LDH between November 2017 and May 2018 in the neurosurgery clinic. Data of patients operated by the same surgeon were included in the study. The decision of surgical intervention was made following preoperative neurological examination, lumbar spinal magnetic resonance image (MRI), and if necessary following lumbar spinal computerized tomography (CT) and lower extremity electromyography (EMG). Of patients who were electively operated, the patients who had not undergone spine surgery before were included in the study (Figure 1).

Furthermore, patients with LDH and with no urgent surgical indication were treated with conservative/medical treatment for at least three weeks. Patients with spinal infections, spinal instability, spinal deformity, multi-level of LDH and patients with spinal tumors concomitant herniated disc were also excluded from the study. Patients with an urgent and elective surgical indication, but who had inadequate data, were excluded from the study.

Data of the patients operated using the same surgical microscope were used. Groups were randomly divided into two subgroups. Patients in the LST group (n=25) served as a group I, and those in the LMD group (n=23) served as a group II. After evaluating the demographic data, clinical evaluations of the patients in both groups were examined to have an opinion of which procedure could be better.

Patients' preoperative visual analogue scale (VAS) scores and postoperative VAS scores were compared. Moreover, analgesic usage period, the duration required for returning to daily life, and length of hospital stay after surgery were the parameters considered during the comparisons. Data obtained were statistically evaluated.

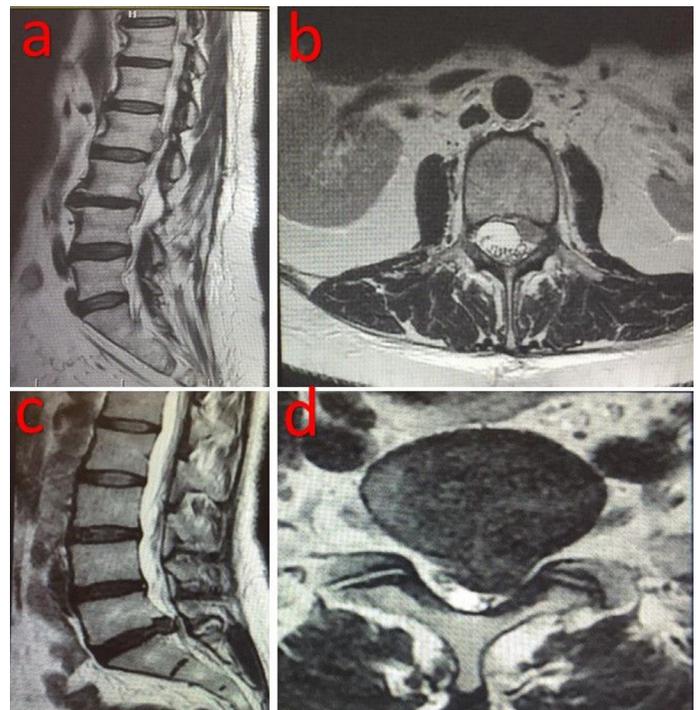


Figure 1. Non-contrast MRI of patient with lumbar disc herniation superiorly migrating left L2-3 (a): T2 sagittal MRI image revealing L 2-3 left lumbar disc herniation migrating upwards (b): Axial MRI image of the same patient (c): Non-contrast T2 sagittal MRI image revealing L5- S1 left paramedian lumbar disc herniation (d): Axial MRI image of the same patient

Surgical technique

Patients were placed in a prone position in both surgical techniques. The surgical level was confirmed using C-arm scopy. Following antisepsis, the sterilized operation site was covered. A midline incision was made approximately two centimeters (cm) above the surgical level in both procedures. After the lumbar superficial fascia was incised, the paravertebral muscles were subperiosteally dissected. Then, a partial hemilaminectomy and flavectomy were performed respectively, using a surgical microscope.

In the surgical procedure of patients who underwent LMD, the dura and spinal root were identified and medialized following flavectomy, then, microdiscectomy was completed using a disc punch after disc capsule was incised with a surgical steel scalpel (no.15 blade).

In the surgical procedure of patients who underwent LST, as within the LMD technique, the dura and spinal root were identified and medialized following flavectomy. However, a sequestered disc fragment was only excised in the LST surgery.

There was a tear of annulus fibrosus or posterior longitudinal ligament in patients who underwent LST surgery.

The operation recesses were irrigated with sterile 0.9% isotonic sodium chloride solution after excision of the disc materials in both surgical methods. The lumbar fascia, skin and under the skin were sutured with appropriate materials in accordance with their anatomical origin. Then, all the patients were extubated and transferred to the hospital room.

VAS Application

VAS scores provided by The Turkish Neurosurgical Society, Spinal and Peripheral Nerve Surgery Group was used for pain intensity assessment (13). VAS is considered as a reliable pain assessment tool in the literature. VAS is made up of a 100 mm of a straight line with the endpoints reflecting limits such as “no pain at all (0)” and “the most unbearable pain (10)”. The patients are requested to mark their pain level on the line between the two endpoints (14).

Statistical analysis

The statistical analyses were performed using Minitab (version 18.0) software, and the alpha significance value was accepted as $p < 0.05$. Descriptive statistics were presented as the mean \pm standard deviation or frequency (%). The Kolmogorov - Smirnov test was used to analyse whether the variables with continuous values display a normal distribution. Mann-Whitney U test was used to compare the differences between independent groups. Independent samples t-test was used to compare two groups for normally distributed data. The chi-square test was used to compare categorical variables between groups. Percentage changes were calculated using preoperative and postoperative values of the parameters. These values were compared using the Wilcoxon signed rank test.

RESULTS

All the patients included in the study were transferred to the

operating room after six hours of fasting and if necessary, after administering sedative pre-medication. As antibiotic prophylaxis, the first-generation cephalosporin was intravenously administered 30 minutes before surgical incision. Surgical procedures were performed under general anesthesia in both groups.

The mean age of the patients in the LST group (Group I; $n = 25$) was 52.84 ± 15.26 years, of which 13 were females (52%). The pathological formations of these patients were common at L2-L3 ($n=1$), L3-L4 ($n=5$), L4-L5 ($n=14$), and L5-S1 ($n=5$) disc levels. The mean age of the patients in the LMD group (Group II; $n = 23$) was 48.87 ± 16.59 years, of which 10 were females (43.48%). Twelve patients (52.17%) in this group had neurological deficits in the preoperative period. The pathological formations of patients in this group were common at L1-L2 ($n=1$), L2-L3 ($n=1$), L3-L4 ($n=4$), L4-L5 ($n=11$) and L5-S1 ($n=6$) disc levels.

There were no postoperative complications in patients in both groups. No re-herniation was observed in the LST group, except for one patient (33 years, female; L4-L5 level). However, this patient responded to medical treatment. The mean postoperative analgesic usage period in the LST group was 2.4 ± 0.58 days, while that in the LMD group was 3.48 ± 0.67 days.

Postoperative deficits in patients with preoperative neurological loss were totally treated in both groups. No patients in the LMD group had a recurrence. Preoperative conservative treatment duration, operation duration, length of hospital stays after surgery, and duration required for returning to daily life were calculated. However, this was not statistically significant ($P > 0.05$) (Table 1).

The VAS scores of low back and leg pain were statistically lower in both groups when examined preoperative and postoperative VAS scores (Figure 2).

Table 1. Comparison of groups including patients operated with different surgical techniques

Groups	Preoperative treatment time (Day; Mean \pm SD)	Operation time (Minute; Mean \pm SD)	Duration of hospitalization (Day; Mean \pm SD)	Time to return to daily life (Day; Mean \pm SD)
Group I (n=25)	11.48 \pm 6.56	35.00 \pm 4.33	21.59 \pm 5.48	15.08 \pm 3.89
Group II (n=23)	13.91 \pm 7.89	43.69 \pm 4.32	24.96 \pm 4.55	20.00 \pm 3.69

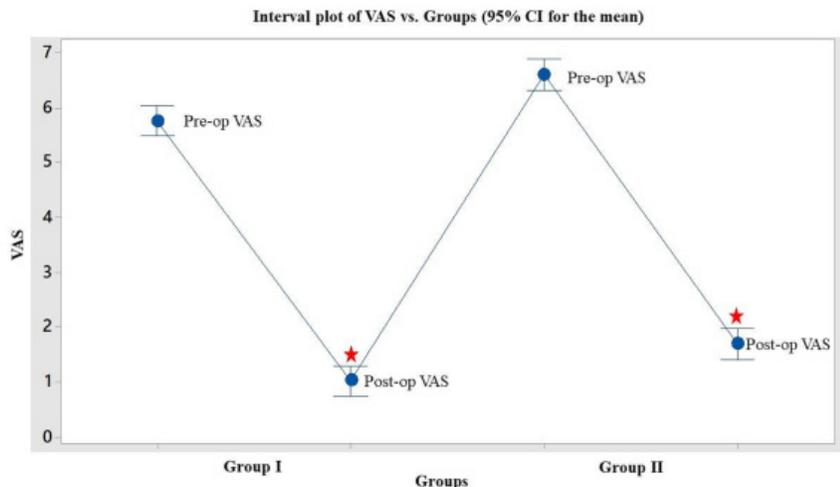


Figure 2. Comparison of VAS scores for both groups, *: $P < 0.05$ in the comparison of the LST and LMD patient groups

DISCUSSION

The most common complaint in patients with LDH is low back pain. Leg pain may accompany the low back pain later. Both undesirable clinical symptoms may sometimes be seen simultaneously. Low back pain may be reduced over time. However, severe pain, as a sciatica-like pain, spreading from the hip to the leg may also be observed. Radicular type pain in the lower extremities may reveal LDH progression (15).

The mechanical compression of the affected neural structure due to disc herniation, then, paresthesia-like symptoms in the areas innervated by the affected nerve due to the biochemical changes in the neural tissue may occur in the progressive periods. Furthermore, weakness in muscle groups innervated by the affected nerve, deep losses in tendon reflexes, sphincter defects may also be observed. Patients may sometimes have symptoms such as physiological posture disorders, gait disturbances, and neurogenic claudication.

This clinical picture originates in the mechanical and chemical response of the disc pathology which leads to the compression of the neural tissue (16). In addition, the entire neural structure below the lesion level may be suppressed due to total affection of the spinal cord in rarely seen LDH cases. In such a case, severe pain, numbness, and weakness in both legs of the patient, as well as sphincter dysfunctions and sexual dysfunctions may occur (17).

Conservative treatment can be applied in most of the cases, however, patients may not respond to this treatment (18). Therefore, operative interventions are appropriate for the patient's refractory to the conservative treatment.

The first LDH surgery was performed by Mixter and Barr in 1934. Yasargil and Williams performed the first microdiscectomy using a microscope in the surgical treatment of lumbar disc herniation (19).

Ozalp et al. reported (20) that microdiscectomy was initially performed for the surgical treatment of soft sequestered disc herniations, however, that it was performed later for the treatment of advanced degeneration and concomitant pathologies. They also suggested that microdiscectomy, a minimally invasive technique, might be more reliable and effective procedure than conventional open discectomy due to the use of a minimal incision, relatively low incidence of subperiosteal muscle dissection, providing a good exposure, and lower blood loss (20).

He et al. reported (21) that microdiscectomy provided less postoperative pain, early mobilization after surgery, and early return to daily life. However, the authors emphasized that there were no significant differences in clinical outcomes of these methods in many studies comparing standard open surgery with microdiscectomy (21).

Some studies (22) reported the appropriateness of microdiscectomy considering the length of hospital stay and the amount of blood loss. Alberto et al. stated

that there were no studies comparing postoperative complications of these two methods (23).

Temiz and his colleagues (24) reported that there was an ongoing debate about the type and technique of surgery in LDH cases, and that microdiscectomy was a more effective procedure with fewer side effects. They denoted that microdiscectomy, where ligamentum flavum is protected, could be performed to prevent postoperative epidural fibrosis. The authors suggested that this surgical method had some disadvantages such as long duration of operation and learning period, but that it had a high potential to prevent postoperative epidural fibrosis (24).

They also reported that this technique could be performed for the treatment of protruded disc herniations with the intact capsule, even if it was designed for the treatment of laterally sequestered disc herniation (24). In that study, the surgical technique applied in patients with LDH was in line with the current literature.

Ozalp et al. (20) stated that in cases where there was no sequestered disc, but only a bulging capsule, the capsule was incised with a surgical steel scalpel (no.15 blade) in parallel to the disc space. Then, all free disc material was removed using disc forceps after entering the disc space with a dissector or nerve hook. They also reported that disc space should be irrigated with physiological serum after completing discectomy (20). Thereby, hemostasis was provided, and free disc material was removed (20).

They stated that sufficient bipolar should be used for bleeding control and that bleeding could be controlled by correcting the semi-flex position. They reported that the muscle layer should not be sutured during the closure phase and that the fascia should be closed with water-absorbable sutures. They emphasized that skin retractor should be removed carefully and that the wound should be closed properly (20). In that study, the dura and spinal root were identified and medialized following flavectomy, then, microdiscectomy was completed using a disc punch after the disc capsule was incised with a surgical steel scalpel (no.15 blade). The operation recesses were irrigated in accordance with the current literature.

Ran et al. (25) reviewed 1642 patients, of which 896 had undergone LMD and 746 had undergone LST. The re-herniation rate in the LMD group ranged from %0 to %10, while that in the LST group ranged from %1 to %21.2. The authors reported that there were no statistical differences between the VAS scores of patients who were operated using two different surgical techniques. Analgesic usage was reported to be less in the LST group. Moreover, they underlined that there were no statistical differences between the hospitalization duration of patients in both groups (25).

Kotil et al. (26) reviewed the long-term results of patients who had undergone either LMD or LST. They reported that re-herniation rate was three times less in patients who had undergone LMD than those who had undergone LST.

However, in the present study, re-herniation was observed in one patient (4%) who had undergone LST, but this was not statistically significant.

CONCLUSION

In conclusion, many minimally invasive procedures have been examined for the surgical treatment of LDH, considering their medical advantages such as the length of hospital stay, the duration for returning to daily life. A variety of non-invasive procedures alternative to the microsurgery have been defined up to now. However, microdiscectomy, a minimally invasive procedure, is still the most effective and common surgical technique (12, 20).

In the present study, VAS scores of low back and leg pain were statistically lower in both groups when examined preoperative and postoperative VAS scores ($P < 0.05$). There were no post-operative complications in patients in both groups. No re-herniation was observed in the LST group, except for one patient (33 years, female; L4-L5 level). The mean postoperative analgesic usage duration in the LST group was lower than that in the LMD group. Postoperative deficits in patients with preoperative neurological loss were totally treated in both groups. No patients in the LMD group had a recurrence. Operation duration, length of hospital stays after surgery, and duration required for returning to daily life were lower in the LST group than that in the LMD group, and this was not statistically significant ($P > 0.05$).

LMD is considered as a gold standard surgical technique for the treatment of patients with LDH in the literature. In the present study, patients who underwent LST had better clinical outcomes. However, the superior features of LST were not statistically significant compared to those of LMD.

That the present study has a retrospective design was the first limitation of the study. The second limitation is that the data of a limited number of patients ($n=48$) who were from the same race were retrospectively evaluated.

LMD is considered as a safe and effective surgical technique for the treatment of patients with LDH in the current literature. It should not be forgotten that LST may provide at least as effective clinical outcomes as provided by LMD in such cases. However, the efficacy of this surgical technique should be investigated with multi-center, randomized, double-blind clinical trials which also have larger series of participants with different races.

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Ethical approval: Ethics committee approval was not obtained since the study had a retrospective design. However, the approval of the director of the Kadiköy Medicana Hospital was obtained to use the archived medical records of the patients (Date: 28-01-2019).

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