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Research

Microendoscopic Discectomy for Lumbar Disc Herniations: A Series of 389 Cases

Lomber Disk Herniasyonlarında Mikroendoskopik Diskektomi Yöntemi: 389 Olgu Serisi

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ABSTRACT

Objective: Lumbar disc herniation is one of the discogenic causes of lower back pain. Patients with severe nerve root compression or progressive neurologic deficit who do not respond to conventional treatments require surgical intervention. These surgical treatments include minimally invasive and traditional methods. In this study, we have presented the clinical data of patients who underwent microendoscopic discectomy (MED)-a minimally invasive method.

Methods: The surgical and clinical data of 389 adult patients who were operated through MED by a single surgeon between 2017 and 2022 were retrospectively evaluated. Parameters such as perop-postop visual analog scale (VAS), follow-up time, duration of hospitalization, and amount of intraoperative blood loss were examined.

Results: Of the 389 patients included in our study, 169 were female and 220 were male, and their mean age was 42.78 years. L4-L5 (n=205, 51.6%), L5-S1 (n=185, 46.8%), L3-L4 (n=4, 1%), and L2-L3 (n=2, 0%) were the most frequently operated levels, showing a sequentially decreasing frequency. Bilateral surgery was performed in two patients. Recurrence was observed in 11 patients (2.8%). Cerebrospinal fluid was detected in 2 (0.5%) patients. The mean pre- and post-op VAS scores were calculated as 7.45 and 1.14, with a significant difference of $p<0.001$. The mean blood loss during surgery was calculated as 9.6±5.8 mL, and the postoperative hospital stay was 17.2±8.5 hours.

Conclusion: MED was comparable to conventional methods in terms of symptom relief, recurrence rate, recovery time after surgery, and intraoperative blood loss.

Keywords: Lumbar disc herniation, microendoscopic discectomy, minimally invasive spinal surgery

ÖZ

Amaç: Lomber disk herniasyonu bel ağrısının diskojenik sebeplerinden biridir. Konvansiyonel tedavilere yanıt alınmayan, ciddi sinir kökü basısı bulguları veya ilerleyici nörolojik defisiti bulunan hastalara cerrahi müdahale gerekmektedir. Cerrahi tedavide, geleneksel yöntemlerin yanında minimal invaziv yöntemler de mevcuttur. Bu çalışmada, minimal invaziv yöntem olan mikroendoskopik diskektomi (MED) ile ameliyat edilmiş hastaların klinik verilerinin sunulması amaçlanmıştır.

Gereç ve Yöntem: 2017 ve 2022 yılları arasında tek cerrah tarafından, MED yöntemi ile ameliyat edilmiş 389 erişkin hastanın cerrahi ve klinik verileri retrospektif olarak değerlendirildi. Perop-postop vizüel analog skala (VAS), takip süresi, hastanede yatış süresi ve intraoperatif kan kaybı miktarı gibi parametreler detaylı bir şekilde incelendi.

Bulgular: Çalışmamıza dahil edilen 389 hastanın 169'u kadın 220'si erkek hastaydı ve hastaların yaş ortalaması 42,78 idi. L4-L5 (n=205, %51,6), L5-S1 (n=185, %46,8), L3-L4 (n=4, %1) ve L2-L3 (n=2, %0,5), azalan sıklıkla, en sık ameliyat edilen seviyelerdi. İki hastada çift taraflı ameliyat yapıldı. On bir hastada nüks izlendi (%2,8). İki (%0,5) hastada BOS (beyin omurilik sıvısı) gelişi oldu. Ortalama pre-op ve post-op VAS skoru 7,45 ve 1,14 olarak hesaplandı ve aradaki fark anlamlı bulundu ($p<0,001$). Cerrahi sırasında kan kaybı ortalama 9,6±5,8 mL olarak hesaplandı. Ameliyat sonrası hastanede kalma süresi 17,2±8,5 saatti.

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Sonuç: MED semptomların giderilmesi, nüks oranı, cerrahi sonrası iyileşme süresi, cerrahi sırasındaki kan kaybı açısından konvansiyonel yöntemlerle karşılaştırılabilecek derecede başarılı bulunmuştur.

Anahtar Kelimeler: Lomber disk herniasyonu, mikroendoskopik diskektomi, minimal invaziv spinal cerrahi

INTRODUCTION

Approximately 60-80% people complain of lower back pain at least once in their lives (1). Lumbar disc herniation (LDH) is one of the discogenic causes of lower back pain. Patients with severe nerve root compression or progressive neurologic deficit who do not respond to conventional treatments for 6 weeks may require surgical intervention. Presently, LDHs with surgical indications are treated via surgical approaches such as open discectomy (OD) and minimally invasive methods such as microdiscectomy (MD), microendoscopic discectomy (MED), and percutaneous endoscopic discectomy.

OD for lumbar disc hernias was first reported in 1934 by Mixter and Barr (2). In this surgical technique, paravertebral muscle stripping and total laminectomy or hemilaminectomy are performed after the standard skin incision. Next, when the microscope begins to enter the surgical field, it was also used by surgeons in lumbar discectomy, and the lumbar discectomy procedure with the microsurgery technique was first documented in 1977 by Yasargil (3) and Caspar (4). Subsequently, this technique gained popularity and, until recently, it was the most preferred surgical method for lumbar discectomy.

Technological advances and the search for a more minimally invasive approach led to the use of an endoscope in lumbar discectomy, and the first step in this direction was taken by Foley and Smith (5). In this minimally invasive technique, termed MED, nerve root decompression is performed using an endoscope. This MED system was modified as the Microscopic Endoscopic Tubular Retraction System [METRx (Medtronic Sofamor Inc., Memphis, TN, USA) in 1999] and customized for use with both a microscope and an endoscope (6).

Although neurological improvement is achieved with OD, complications are frequently observed in the postoperative period due to damage to the paraspinal muscles, connective tissues, and ligamentum flavum during surgery, with prolonged recovery times. As an alternative and less invasive surgical approach, MED is frequently preferred as the surgical approach of choice. As it is less invasive, the damage to the paraspinal muscles is less via this approach. However, some studies have demonstrated that clinical improvement [reduction in the visual analog scale (VAS) scores] was comparable to that with other methods. Some studies argue that MED is unsuccessful compared to other minimally invasive methods (7). Therefore, much more work is needed to obtain more accurate data when comparing MED with the other methods. Accordingly, in our study, we have presented the clinical results of patients who were operated on by MED.

METHODS

In this study, 389 adult patients who were operated on via MED by a single surgeon at a single center between 2017 and 2022 in our clinic were included. The surgical and clinical data of the patients were retrospectively evaluated. Parameters such as preop-postop VAS, follow-up time, duration of hospitalization, and amount of intraoperative blood loss were examined. Patients with spondylolisthesis-associated disc herniation, spondylodiscitis, diffuse lumbar stenosis, irregular postoperative follow-ups, and spondylodiscitis for whom sufficient arguments could not be reached were excluded from the study despite being operated on with the MED method.

This study was approved by the Malatya Turgut Özal University, Non-Invasive Clinical Research Ethics Committee (no: 2022/216, date: 13.12.2022). Written informed consent was obtained from the patient.

Statistical Analysis

Statistical analyses were performed using the SPSS program. Continuous variables were expressed as mean and categorical variables as percentages. The chi-square test was performed for the difference between categorical variables and the t-test was performed for the difference between continuous variables. The paired sample test was performed to evaluate the variation in continuously calculated value in the same sample over time.

Surgical Technique

The patients were placed in the prone position on a radiolucent surgical table under spinal epidural anesthesia. Cefazolin or ceftriaxone was given as a prophylactic antibiotic. The surgical table was bent to appropriately open the lumbar spine-the interlaminar space. The sides are supported with a pillow to avoid abdominal compression. The following distance determination with a 20-gage spinal needle under C-arm fluoroscopy (Figure 1A), the incision line was determined. After cleaning the surgical field and

appropriate sterile draping, a 1.5-2 cm skin incision was made 1-2 cm lateral to the midline entering from the symptomatic side, and the incision was deepened to include the lumbar fascia. After the incision, a spinal endoscopy system EasyGo (Karl Storz, Tuttlingen, Germany) was placed. This system consisted of a high-resolution camera, a 30° wide-view telescope with adjustable size, and several series of tubular dilators and retractors. It was advanced from the smallest muscles (5.2-mm diameter) to the lamina by a twisting motion (Figure 1B). The sweeping action of the dilator also helped in subperiosteal muscle separation. Examination with lateral fluoroscopy ensured that the dilator position was at the correct level. Larger dilators were placed sequentially until the appropriate dilator was deployed (Figure 1C). At each stage, the bony structure was felt with a dilator, thus avoiding inadvertent penetration of the interlaminar space. The tubular retractor (15, 19 or 23 mm) was placed after the dilators and connected to the flexible arm fixed to the operating table. Finally, the endoscope was carefully inserted and connected to the tubular retractor using the corresponding insert (Figure 1C). The video monitor was set in the front of the operating table facing the surgical team. The was examined again with lateral fluoroscopy before securing the endoscope system to the tubular retractor (Figure 1D). The endoscope camera system was set at 6 o'clock relative to the surgeon on a fixed tubular retractor to ensure that the orientation on the monitor matched the actual anatomical orientation. Hemipartial laminectomy was then performed using a Kerrison rongeur and high-speed tour. Using a dissector or curette, the ligamentum flavum was opened and separated from the superior lamina. The fragments were then collected with a Kerrison rongeur. After the tecal sac dura and nerve root were visualized, they were dissected with a Penfield dissector or blunt nerve trunk (Figure 2A).

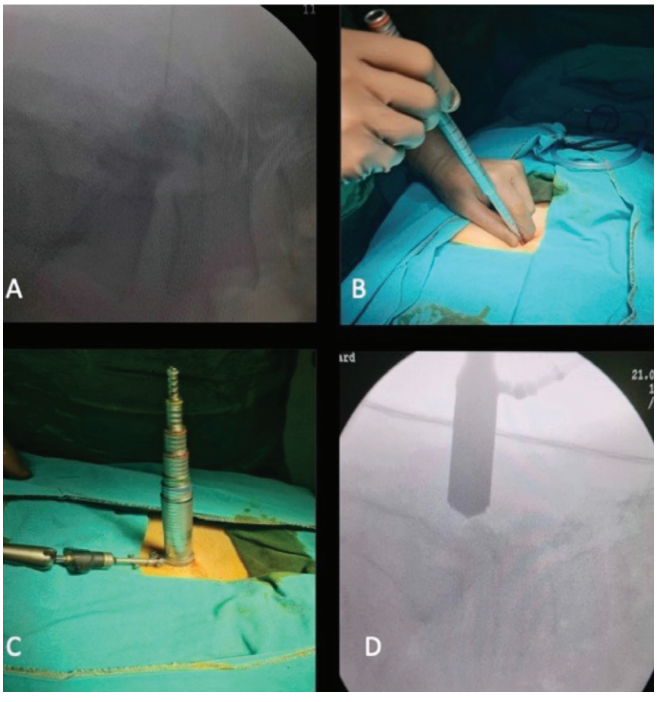

Figure 1. Placement of the MED system
MED: Microendoscopic discectomy

The nerve root is excised with the help of a retractor to expose the disc. In case of bleeding from epidural veins, it can be coagulated with bipolar forceps. After the disc fragment is freed, it is grasped with forceps and removed (Figure 2B-D). If the fragment is under the capsule, the capsule needs to be cut. For this, special hooked scissors can be used and then the herniated disc content can be removed. After the bleeding was controlled, the surgical cavity was washed with plenty of saline. The tubular system was removed and the operation was terminated by closing the layers in the anatomical plane. In the early postoperative period, the patient was documented by MRI and comparing the pre- and postoperative images (Figure 3).

RESULTS

A total of 389 patients who were operated on via the microendoxopic approach were included in the study. There were 169 female and 220 male patients (F:M=0.76). The mean age at the time of surgery was 42.78 years (standard deviation =11.56). A total of 395 levels were operated on in

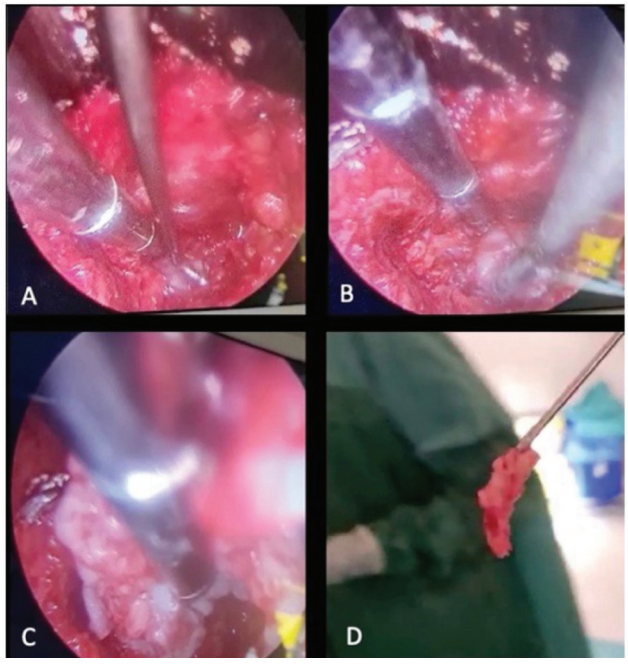

Figure 2. Removal of herniated disc contents

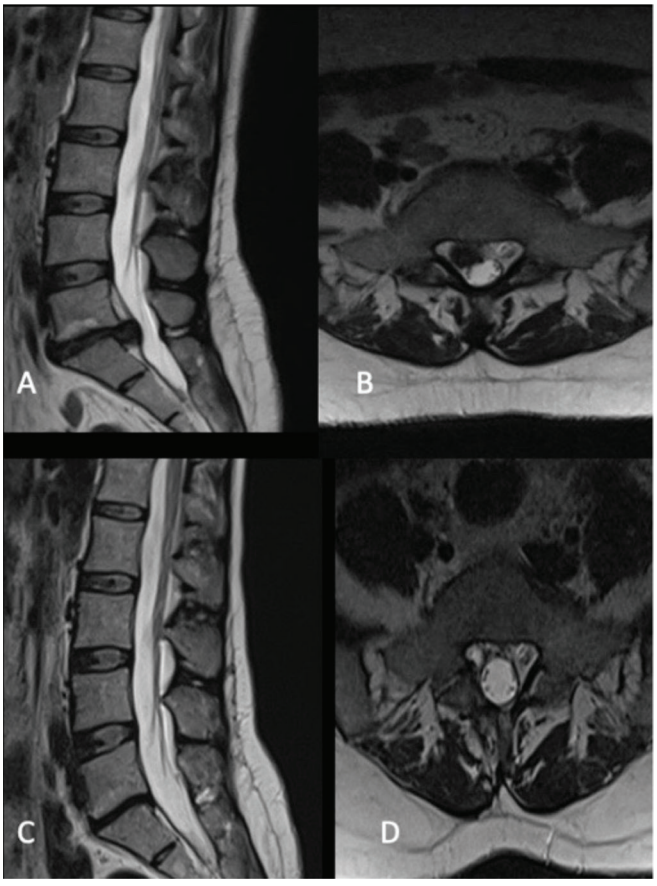

Figure 3. Pre-op and post-op T2 sequence magnetic resonance images

389 patients (two levels were operated on 6 patients). L4-L5 (n=205, 51.6%), L5-S1 (n=185, 46.8%), L3-L4 (n=4, 1%), and L2-L3 (n=2, 0%) were the most frequently operated levels, with a decreasing frequency (Table 1). Bilateral surgery was performed on two patients. The remaining patients underwent unilateral surgery.

Recurrence was recorded in 11 patients (2.8%). Two of these relapses were followed in the first month and the remaining within the first year. Seven of these patients underwent repeat MED and the other four underwent OD.

CSF was detected in only two (0.5%) patients. There were no complications such as nerve root damage and neurological deficit in any patient.

VAS was recorded in the pre- and postoperative periods for clinical follow-up. The mean pre- and post-op VAS scores were calculated as 7.45 and 1.14, and the difference was significant ($p<0.001$). The mean time to postoperative VAS score recording was 8.41 months after surgery. Only two patients required postoperative scar revision (0.5%).

The mean amount of blood lost during the operation was calculated as 9.6±5.8 mL. The postoperative hospital stay was 17.2±8.5 hours (h).

Table 1. Data of patients who underwent surgery with the MED method

Particular	Value
Gender	
Woman	169 (43.4%)
Men	220 (56.6%)
Age (year ± SD)	42.8±11.6
Level (n, %)	
L1-L2	0 (0%)
L2-L3	2 (0.5%)
L3-L4	3 (0.8%)
L4-L5	199 (51.2%)
L5-S1	185 (47.6%)
Pre-op VAS	7.4±0.7
Post-op VAS	1±0.4
Amount of bleeding (cc ± SD)	10±5.8
Dural tail	2 (0.5%)
Follow-up time (month ± SD)	8±2.8
Hospital stay time (hour ± SD)	17±8.5
Recurrence	11 (3%)
Infection	0 (0%)

MED: Microendoscopic discectomy, SD: Standard deviation, VAS: Visual analog scale

DISCUSSION

In the management of patients with LDH with surgical indications, the choice of surgical method is determined based on the surgeon's experience, available technical capacity, and patient-related factors. Endoscopic approaches allow for smaller incisions and less tissue trauma compared with standard open MD. Because the MED procedure causes significantly less iatrogenic damage to the paraspinal musculature, it can provide additional long-term benefits. OD was once considered the "gold standard" treatment for LDH (8). However, the tendency toward minimally invasive methods is gradually increasing because it disrupts the posterior structure of the spine and causes segmental instability and long-term problems.

The MED technique, which emerged as an alternative to OD introduced by Smith and Foley, has been used successfully for treating LDH since 1997 (5,9). The optimal indication for MED has been defined as unilevel radiculopathy secondary to LDH (5). The use of MED is not recommended in patients with segmental instability and lower back pain-related herniation, lumbar stenosis and herniation, or previous

lumbar surgery (10). This factor does not indicate that surgeries cannot be performed using the MED method. It needs to be emphasized that these surgeries are very difficult for a beginner-level surgeon and may increase the complication rate if not performed correctly; thus, advanced experience in the MED method is required.

The success rate for MED has been described as 90% in the literature, and the recurrence rate has been reported as approximately 5% (11). In this case series, recurrence was observed in only 11 of the 389 patients, with a recurrence rate of approximately 3%.

In a randomized comparative study by Teli et al. (7), the recurrence rate was 11.4%, and the rate of dura and root damage, motor deficit, and spondylodiscitis was higher in patients operated on by the MED method when compared to MD and OD. When the study was examined, we noted that the surgical experience of the doctors adopting the MD and OD methods was twice that of a surgeon adopting the MED method, and the number of patients was insufficient. Such factors make us reluctant to reach a definite conclusion and make any comparisons. In our study, the recurrence rate was 3% and dural damage was 0.5%, and when combined with the absence of complications such as root injury, spondylodiscitis, and motor deficits, our opinion seems justified.

In the study of Wu et al. (6), in which they published the data of 873 patients who underwent surgery with the MED method, preop and postoperative VAS scores were 7.8 and 2.3, respectively. The mean blood loss and hospital stay duration was 44 cc and 4.8 days, respectively. In our study, preop and postoperative VAS scores were calculated to be 7.45 and 1.14; these findings were similar to those of Wu et al. The mean amount of blood lost during the operation was 9.6±5.8 mL, while the postoperative hospital stay was 17.2±8.5 h. In addition to the complication rates, the low blood loss that occurred during the operation and the shorter length of stay in the hospital acted as important indicators of comfort for the patients.

One of the most important reasons for shorter hospital stays in MED patients is the minimal level of paraspinal muscle damage compared with OD (12). Other factors that may be associated with rapid healing are limited traumatic nerve root dissection, less bone removal, and shorter skin incision (13). According to Cheng et al. (14), the amount of intraoperative damage is less in MED patients than in OD patients.

In our study, only two patients needed scar revision in the postoperative period. In addition, no wound or infective complication was encountered during the postoperative period. Li et al. (15) reported that although the complication rate in MED patients was numerically higher than that in OD, this difference was not statistically significant.

Masuda et al. (16) evaluated 3961 patients who were operated on with the MED, MD, and OD methods. Although it was stated that this rate was higher than MD and OD, it was not significant when the age, gender, and comorbidities of the patients were considered.

Several studies are comparing the MED method with percutaneous endoscopic lumbar discectomy (PLED). In a study by Xu et al. (17), in which these studies were meta-analyzed, 9 studies, 516 in the MED group and 468 in the PLED group, were evaluated.

Because of meta-analysis, no difference was detected between the two groups in the preop-postop VAS scores for complications, recurrence, reoperation, and leg pain. It was determined that the PLED method gave better results than the MED method in terms of the evaluation of VAS for lower back pain. This meta-analysis revealed that the results of the MED method compete with those of other minimally invasive methods.

In conclusion, according to our study, MED emerged as a preferred method with a low complication rate. However, the MED technique involves a learning curve that must be carefully overcome. The two-dimensional endoscopic view and hand-eye coordination can also confusing compared with open surgery. Other variables affecting the learning curve include familiarity with instruments, three-dimensional understanding, and the command of anatomical structures. To master the MED procedure, the surgeon must willingly invest a significant amount of time and effort in relevant education and training. For a surgeon who has completed the learning curve, maintaining and publishing records of surgeries performed with the MED technique is as important as the surgery itself to allow for healthier comparisons in the future.

CONCLUSION

MED is a less invasive surgical method developed as an alternative to the related conventional methods. Damage to the paraspinal muscles, ligamentum flavum, and other soft tissues is less common in surgeries performed using MED. Moreover, the recovery period after this surgery was shorter. In our study, clinical and surgical data of 389 patients who underwent discectomy with MED are presented. MED was found to be comparable to conventional methods in terms of symptom relief, recurrence rate, recovery time after surgery, and intraoperative blood loss.

ETHICS

Ethics Committee Approval: This study was approved by the Malatya Turgut Özal University, Non-Invasive Clinical Research Ethics Committee (no: 2022/216, date: 13.12.2022).

Informed Consent: Written informed consent was obtained from the patient.

Authorship Contributions

Surgical and Medical Practices: B.B., Concept: B.B., B.A., A.E.T., H.H.K., Design: B.A., G.Ü., H.H.K., Data Collection or Processing: B.B., C.Ü., Analysis or Interpretation: B.B., B.A., G.Ü., A.E.T., Literature Search: B.A., C.Ü., Writing: B.B.

Conflict of Interest: No conflict of interest was declared by the authors.

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