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CLINICAL AND RADIOLOGICAL RESULTS OF POSTERIOR DECOMPRESSION AND FUSION SURGERY IN DEGENERATIVE LUMBAR SPINAL STENOSIS

DEJENERATİF LOMBER SPİNAL STENOZDA POSTERİOR DEKOMPRESYON VE FÜZYON UYGULAMASININ KLİNİK ve RADYOLOJİK SONUÇLARI

Baran KÖMÜR[1],
Serhat MUTLU[1],
Tahir Mutlu DUYMUŞ[1],
Barış YILMAZ[2],
Erdem KAAN[3],
Funda ATAMAZ[4],
Mehmet ARGIN[5],
Erhan SESLİ[6]

[1]S.B.Kanuni Sultan Süleyman Education and Research Hospital, Department of Orthopaedics and Traumatology / Istanbul
[2]S.B.Fatih Sultan Mehmet Education and Research Hospital, Department of Orthopaedics and Traumatology / Istanbul
[3]Dr.Ersin Arslan State Hospital, Department of Orthopaedics and Traumatology /Gaziantep
[4]Ege University Faculty of Medicine, Department of Physical Therapy and Rehabilitation / Izmir
[5]Ege University Faculty of Medicine, Department of Radiology / Izmir
[6]Şifa University School of Medicine, Department of Orthopaedics and Traumatology/ Izmir

Address: Tahir Mutlu Duymuş, Eczacı Necip Akar sk Detay Apt. No 29-10 Acıbadem mah. Üsküdar- İstanbul
Tel. : 0532 3542534
E-mail: dr.tahirmutlu@gmail.com
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SUMMARY

Background: The aim of this study is to evaluate the radiological and clinical data of patients with degenerative lumbar spinal stenosis (DLSS) who were treated by posterior decompression and fusion.

Materials and Methods: 30 patients (17 female, 13 male) were evaluated in this study, who were diagnosed with DLSS and underwent surgery between 1999 and 2005. The lumbar spinal canal was measured with CT scans of the surgical level, and one level above and one level below the operated level. All patients were evaluated with the Oswestry questionnaire and clinical examination scale (existence of back pain, leg pain, numbness, prickling sensation, motor deficiency and sensory deficiency). The preoperative and postoperative patient satisfaction was evaluated with the Visual Analog Scale (VAS).

Results: The mean follow-up time was 4.3 ± 3.7 years. The preoperative spinal canal diameter was 12.4 ± 3.3 mm, whereas postoperatively it was 14.0 ± 2.8 mm. The postoperative clinical scale and Oswestry questionnaire were found to be significantly improved ($p<0.05$). The mean preoperative VAS satisfaction was 27.4 ± 13.6, and the mean postoperative VAS satisfaction increased to 56.3 ± 24.5. Significant negative correlations (Spearman Rank Correlation) were found between the VAS scores and Oswestry questionnaire scores ($r=-0.65$) and the VAS scores and the postoperative clinical scale ($r=-0.63$) ($p<0.05$).

Conclusion: A statistically significant recovery was found for patients treated by posterior decompression and fusion who had degenerative lumbar spinal stenosis (DLSS). The clinical finding score was related to the radiological data. Posterior decompression with instrumented fusion is an effective treatment for DLSS.

Key Words: Lumbar spinal stenosis, degenerative, decompression, clinic results.

Level of Evidence: Retrospective clinical study, Level III

ÖZET

Amaç: Dejeneratif lomber spinal stenoz (DLSS) nedeniyle posterior enstrümante dekompresyon ve füzyon uygulanan olguların sonuçlarının klinik ve radyolojik olarak değerlendirilmesi.

Materyal ve Metod: 1999-2005 yılları arasında DLSS nedeniyle opere olan 30 olgu (17 K, 13 E) değerlendirmeye alındı. Tüm olguların opere olduğu seviyede ve opere olduğu seviyenin bir üst ve bir alt vertebralarındaki lomber spinal kanalları bilgisayarlı tomografi (BT) eşliğinde ölçüldü. Olgular klinik olarak Oswestry soru anketi ve 6 puanlık klinik bulgu ölçeği (bel ağrısı, bacak ağrısı, uyuşukluk, karıncalanma, motor kayıp ve duyu kaybı varlığı) ile değerlendirildiler. Preoperatif ve postoperatif memnuniyet Visual Analog Skala (VAS) ile ölçüldü.

Bulgular: Olguların ortalama takip süresi 4.3±3.7 yıl olarak saptandı. Operasyon öncesi kanal çapı12.4±3.3 mm iken ameliyat sonrası 14.0±2.8 mm olarak ölçüldü. Postoperatif klinik bulgu ve Oswestry anketi anlamlı olarak iyi yönde değişti ($p<0.05$). Olguların ortalama preop VAS memnuniyeti 27.4±13.6 idi. Ortalama postoperatif VAS ile memnuniyeti ise 56.3±24.5 olarak artmış saptandı. VAS ile diğer parametrelerin korelasyonuna bakıldığında (Spearman Rank Korelasyon) Oswestry ($r=-0.65$) ile postoperatif klinik bulgu ölçeği ($r=-0.63$) ile anlamlı negatif korelasyonlar elde edildi ($p<0.05$).

Sonuç: DLSS nedeniyle cerrahi olarak tedavi edilen olgularda gerek klinik, gerek radyolojik olarak takipleri sonucunda istatiksel olarak anlamlı bir iyileşme saptanmıştır. Olguların klinik ve radyolojik iyileşme oranları birbirleri ile uyumlu olarak tespit edilmiştir. LSS'un tedavisinde posterior dekompresyon ve enstrümante füzyon yöntemi etkili bir tedavi yöntemidir.

Anahtar Kelimeler: Lomber spinal stenoz, dejeneratif, dekompresyon, klinik,

Kanıt Düzeyi: Retrospektif klinik çalışma, Düzey III

INTRODUCTION:

Spinal stenosis is a narrowing of the spinal canal, lateral recess or neural foramen due to bone or soft tissue compression[1]. The structure of a normal vertebra is a tripod configuration that permits symmetrical rotation and angulations without any narrowing of the discs, facet joints, ligaments, spinal canal, or neural foramina. However, in the acquired degenerative form that occurs particularly in the mobile lumbar region, as a result of degenerative changes in the joint complexes that provide lumbar spine mobility in the elderly, the central canal and neural foramina adapt less well to rotational forces and do not adapt to tensional stress. Various degrees of laminar thickening, facet hypertrophy and annular displacement lead to nerve root compression and inflammation in the neural structures of the cauda equina. This leads to neural claudication, the fundamental clinical picture of spinal stenosis[10].

This condition frequently occurs in women during the seventh decade of life, and is generally termed degenerative lumbar spinal stenosis (DLSS). Due to the slow progression of this disease, the onset of clinical symptoms is generally slow and insidious. The L3–4 and L4–5 levels are mostly involved. As well as lower back pain, neural claudication and pain spreading to the lower extremities reduce the walking capacity and limit mobility. Conservative treatments may reduce symptoms, but the underlying pathology remains and it is not possible to achieve very good results in the long term with conservative treatment. However, patients with mild symptoms may be candidates for an initial conservative approach[11].

The surgical indications include cases that are unresponsive to conservative methods, and severe pain limiting the daily life activities of the patient. The best patients for surgery are those with severe neural claudication and without gross lower back pain, neurological deficit, or severe co-morbidity. First, a differential diagnosis should be made by vascular claudication. Standard surgery for spinal stenosis consists of laminectomy and nerve root decompression. The mostcontroversial issue is the addition of fusion (and instrumentation) to decompression. Nevertheless, the most widely used surgical techniques are decompression with or without instrumentation and fusion. Controlled clinical studies have shown that surgical treatment is superior to conservative treatment, but there is currently no consensus on the surgical approach. There is also an ongoing debate on the advantages of conservative and surgical treatment[2,4].

In this study, we evaluated the radiological and clinical results of patients who underwent posterior instrumentation, decompression and fusion due to DLSS.

MATERIALS AND METHODS:

In this retrospective study, we evaluated 30 patients who received posterior instrumentation, decompression and fusion due to DLSS between 1999 and 2005. The pre- and postoperative records of the patients were examined. All patients received some conservative treatment before surgery, such as medication, epidural injection (EI), and physical therapy (exercises to strengthen the abdominal muscles, motion modifications limiting extension, orthosis, deep heating, pelvic traction, and thermal spring). They were all unresponsive to these treatments. All patients underwent a comprehensive neurological examination. Preoperative imaging included four-way lumbosacral X-rays (AP, lateral, two-way oblique), flexion-extension X-rays to demonstrate dynamic instability, and MRI. EMG and myelography were used for diagnosis. Stenosis was classified as foraminal and extraforaminal. All patients had posterior instrumentation together with a polyaxial screw allograft and fusion under fluoroscopy (Figure-1). All operations were performed by the same surgeon (E.S.).

The lumbar spinal canal diameters at the vertebral surgical level, together with the upper and lower levels, were measured using computed tomography (CT) (Figure-2). The canal diameter measurements were performed using the method published by Hashimoto et al., which was used to measure the canal diameter following vertebral fractures[9]. The

surgical level was measured. The arithmetic mean of the upper and lower levels was accepted as the normal preoperative diameter of the spinal canal.

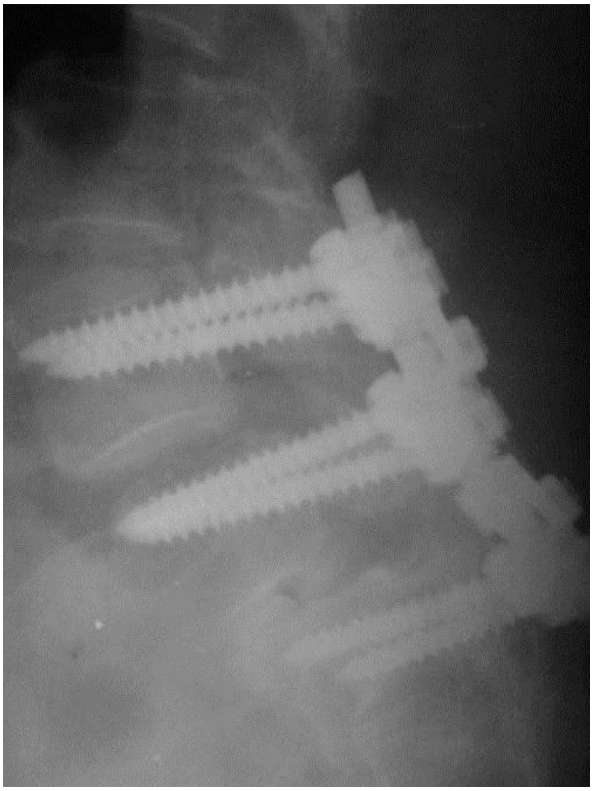


Figure-1. Lateral lumbosacral X-ray of a patient with posterior instrumentation

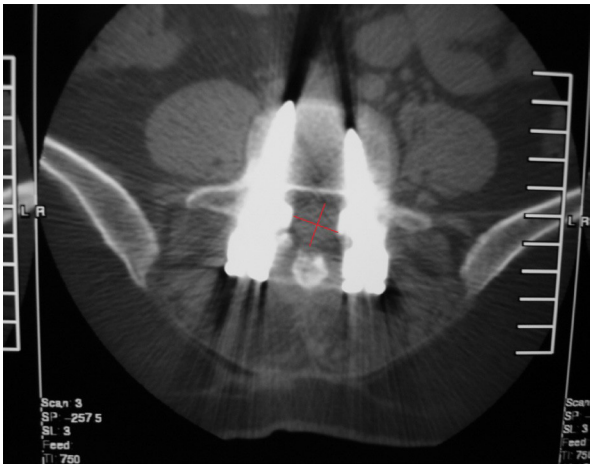


Figure-2. Measurement of canal diameter at the surgical level.

The patients were evaluated by the clinical symptom scores, where each symptom was one point. These symptoms consisted of lower back pain, leg pain, numbness, pins and needles, motor deficit, and sensory deficit (Table-1). Each patient had a global score calculated by the sum of thepoints. The pre- and postoperative pain scores were measured using the visual analogue scale (VAS). The pre- and postoperative pain intensity for all patients was determined using the VAS scores. In order to determine the effect of the leg and lower back pain on daily life activities, the Oswestry Disability Index (ODI) was used.

Table 1. Parameters evaluated in the Clinical Symptom Scale

Evaluation of Clinical Symptom Scale		
	PRESENT	ABSENT
Lower back pain	1	0
Leg pain	1	0
Numbness	1	0
Pins and needles	1	0
Motor deficit	1	0
Sensory deficit	1	0

Comparisons of the spinal canal diameters and the VAS scores were made by paired sample t-test. The relationship of the VAS, Oswestry and clinical symptom scores were made using Spearman's Rank Correlation.

Surgical Technique:

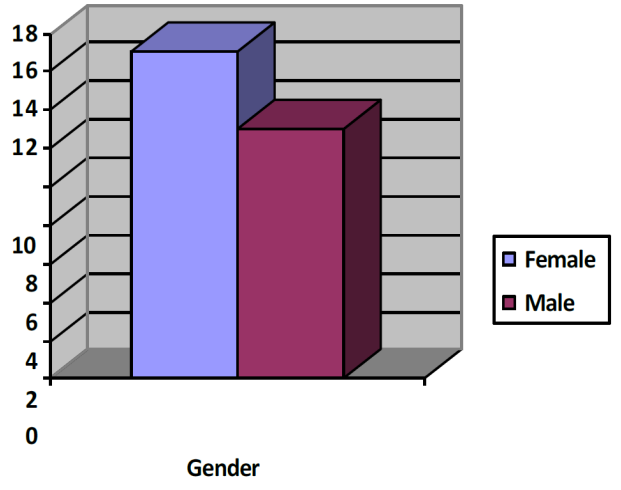
Preoperative antibiotic prophylaxis was done with 1 g of intravenous cefazolin one hour before surgery. Pre- and postoperative anti-thromboembolic therapy was given with low molecular weight heparin (fragmin 5000 IU 1×1; fraxiparin 0.4–0.6 1×1; clexan 0.4–0.6 1×1), and postoperative treatment was continued for up to three weeks. In order to prevent deep venous thrombosis, antiembolic stockings were put on both lower extremities after surgery. The patients were operated on in a prone position. In order to prevent venous return blockade and femoral vein compression, cushioning was used. To protect respiratory function, both chest sides were cushioned. Surgery comprised of a classical posterior approach (laminectomy, facetectomy (total or more

than 50%), foraminotomy and instrumentation, and fusion). Discectomy was done when necessary. An allograft was used for posterior fusion.

RESULTS:

The study included 30 patients (17 (56.7%) women and 13 (43.3%) men) (Table-2). The mean age of the patients was 65.2 ± 9.3 years and the mean follow-up was 4.3 ± 3.7 years. All patients had lower back pain and leg pain. All patients were retrospectively examined for chronic conditions such as diabetes (DM) and hypertension (HT). Five patients had HT and four patients had DM. One patient had both DM and HT. The mean operation time was 105 (75–180) min. The amount of perioperative blood tranfusion was 620 (0–1700) cc. The mean hospital stay was 4 (3–7) days.

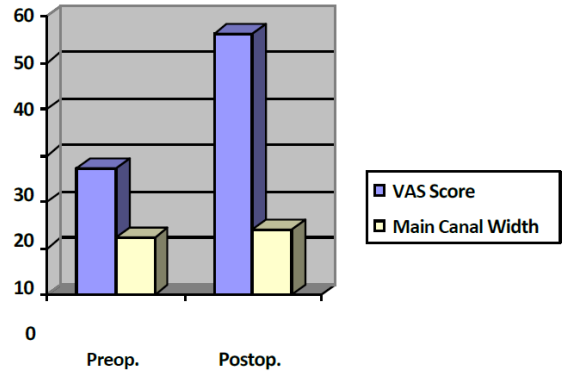
Table-2. Gender distribution of degenerative lumbar spinal stenosis



The mean canal diameter before surgery was 12.4 ± 3.3 mm, whereas it was 14.0 ± 2.8 mm after surgery. The pre- and postoperative VAS satisfaction scores were 27.4 ± 13.6 and 56.3 ± 24.5, respectively (Table-3).

The postoperative mean Oswestry score was was 2.7 ± 1.0. As the preoperative Oswestry scores and symptom scores were not available, correlation analyses were made between the postoperative VAS score, the Oswestry score and the clinical symptoms. There was a significant negative correlation between the postoperative VAS and Oswestry scores ($r=-0.65$; $p<0.05$). Furthermore, there was a significant negative correlation between the postoperative VAS and clinical symptom scores ($r=-0.63$; $p<0.05$).

Table-3. Changes in VAS scores before and after surgery



Two (6.7%) patients required implant revision. They had received implants from an external center. None of the patients developed infections after surgery. One patient had previously had surgery due to cervical herniation. Fusion was achieved in all patients.

DISCUSSION:

DLSS is the most common reason for lumbar spinal surgery over the age of 65. Although DLSS is treated by surgery globally, the long-term outcomes of surgery are not clear. Some authors report excellent–good results in the long term, whereas others report moderate–bad results[4,6,8]. The possible reasons for this discrepancy may include differences in the surgical plan, in the subjects that were excluded or included, and measurement differences. The surgical treatment of DLSS has two main goals. Firstly, to decompress the degenerative tissues compressing the spinal canal, intervertebral foramina and neural structures (cauda equina and nerve roots) mechanically, and secondly, to correct deformities

in the sagittal and coronal planes and eventually to recover the stability of the spinal canal. In large decompressive laminectomy, direct visualization and decompression of the nerve root make this technique the gold standard for DLSS surgery. However, long-term studies report iatrogenic instability, postoperative spondylolisthesis and epidural fibrosis after laminectomy[6,8]. We observed no such complications, but this may be due to the relatively short follow-up period.

In a study by Yamashita et al., the surgical efficacy shown to be 14.7±8.0. The postoperative mean clinical symptom score was investigated in 70 patients with DLSS[14].

They suggested that the recurrence rate increased with aging and that the VAS scores for women were higher than men. In our study, no gender stratification was performed, but no patients had a preoperative VAS score that was worse than the postoperative VAS score. Gelalis et al.[7] investigated 50 DLSS patients who received surgery in a study in which fusion was added to spinal decompression for five (10%) of the 50 patients. The mean follow-up period was 11.6 years and resulted in an excellent outcome for 23 patients, good for 13, moderate for nine, and bad for five patients. Excellent–good results were shown for patients who received simultaneous fusion. Panagiotis et al. performed posterior instrumentation and fusion for 41 patients with DLSS, with a 3.7 year follow-up[12]. None of the patients had recurrent stenosis, and 39 of the 41 patients operated on reported satisfactory results. None of the patients showed recurrent stenosis or an increase in pain postoperatively.

The practice of fusion in spinal surgery is a method that increases the surgical success in patients with instability and deformity (such as advanced spondylosis and degenerative scoliosis)[3]. Fusion has been suggested to provide support to the posterior column in the long term. Various opinions on fusion are present. Some authors do not recommend fusion, whereas others report better clinical results with fusion[5,13]. Surgical intervention takes longer with the addition of fusion. The blood loss and morbidity increase, and the postoperative rehabilitation period lengthens. However, there is a consensus that fusion should be added for DLSS when degenerative spondylolisthesis is present. The advantages ofadding instrumentation to fusion include correction of deformity, increase in the fusion rate, limitation of the segment number, and shortening of the postoperative rehabilitation time. In our study, all patients underwent fusion together with posterior instrumentation.

Recently, unilateral pedicle screws and fusion have been applied for DLSS treatment[15]. The goal of this approach is to reduce the tension of the implant, which has been shown to increase biomechanically and clinically during the postoperative period. However, the posterior instrumentation and fusion approach is still valid for DLSS treatment.

Zhao et al. performed this technique on 79 patients with DLSS, and used a diagonal cage for a unilateral transpedicular screw approach together with fusion[16]. A three year follow-up period showed successful fusion, reduction in pain and an increase in daily life activities. In our study group, all patients underwent posterior instrumentation and fusion. There was no implant failure, but revision was required for two patients who received their implants in an external center.

Significant improvement was found in both the radiological and clinical aspects of DLSS patients who were treated with surgical intervention. The rates of the clinical and radiological improvement were in parallel. The weaknesses of this study are the lack of a long-term follow-up, and the measurements are based on subjective parameters. Although there is agreement on the need for surgery for DLSS, no consensus has been obtained on fusion and instrumentation. Although the benefits of adding fusion to posterior instrumentation are not clear in the literature, our results suggest beneficial effects during a mid-term follow-up.

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