Comparison of two types of surgery for lumbar spinal stenosis in elderly: decompressive laminectomy with and without fusion

Yaşlılarda lomber spinal stenoz için iki tip cerrahinin karşılaştırılması: füzyonlu ve füzyonsuz dekompresif laminektomi

Tayfun ÇAKIR1, Şeyho Cem YÜCETAŞ2

1 Erzincan Binali Yıldırım University, Medical Faculty, Department of Neurosurgery, 24100, Erzincan-Turkey
2 Adıyaman University, Medical Faculty, Department of Neurosurgery, 02040, Adıyaman-Turkey

Abstract

Aim: To compare decompressive total laminectomy with and without instrumented fusion.

Materials and Methods: 54 patients who underwent decompression formed the group 1, and 48 patients who underwent decompression plus fusion formed group 2. Patients were compared in terms of age, sex, body mass index, duration of surgery, length of hospital stay, visual analog scale (VAS) and Oswestry disability index (ODI) scores and complications.

Results: No significantly differences about age, sex, body mass index (BMI), length of hospital stay were found between the groups. There was significant difference between the groups about mean operative times (p<0.05). In both of the groups VAS scores improved significantly. In both groups there was statistically significant decrease in ODI values. And second surgery requirement was significantly higher in the group 2 (p<0.01).

Conclusion: Facet protective decompression surgery performed up to two levels can be successfully terminated without fusion.

Keywords: Spinal; Stenosis; Laminektomy; Fusion; Elderly.

Öz

Amaç: Lomber spinal stenoz cerrahisinde füzyonlu ve füzyonsuz dekompresif laminektomi yapılan hastaların 3 yıl sonundaki klinik bulgularını ve komplikasyon oranlarını karşılaştırmak.

Gereç ve Yöntem: Grup 1'de tek başına dekompresyon uygulanan 54 hasta, grub 2'de ise dekompresyon ve posterior transpediküler füzyon uygulanan 48 hastaydı. Ameliyat süresi, hastanede kalış süresi, yaş, cinsiyet, vücut kitle indeksi gibi özellikler değerlendirildi. Hastaın fiziksel ağrı skalası (VAS), Oswestry disability index (ODI) skorundan değişim ve komşu segment sendromu gibi komplikasyon oranları karşılaştırıldı.

Bulgular: Yaş, cinsiyet, vücut kitle indeksi (VKI) ve hastanede kalış süresi açısından anlamıamsız bir farklılık yoktu ama ameliyat süresi açısından anlamli fark vardı (p<0.05). İki grupta da VAS ve ODI açısından anlamli şekilde iyileşme gözlandi. Grup 2'de 3 yıllık süreç içerisinde ikinci cerrahi gereksinimi daha yüksek bir (p<0.01).

Sonuç: İki seviyede kadar yapılan dekompresyon cerrahisinin füzyon gerektirmeden başarıyla yapılabileceği sonucuna varıldık.

Anahtar Kelimeler: Spinal; Stenoz; Laminektomi; Füzyon; Yaşlılık.
Introduction

Just about 80% of the society complain of low back pain in any part of their lives.\textsuperscript{1,2} Lumbar spinal canal stenosis (LSCS) due to degenerative changes is one of the causes of persistent low back and leg pain and a serious disorder mainly affects elderly people.\textsuperscript{3,4} Also neurogenic claudication caused by LSCS greatly reduces the quality of life. Despite the advanced age, the majority of these patients were generally decided to have surgical intervention.\textsuperscript{5-7} Recent studies stated that rates of surgery have been increasing dramatically in the world.\textsuperscript{8,9} Although there have been studies reporting surgical intervention is not superior to conservative treatment at long-term follow-ups, most studies have reported that satisfactory results have been obtained after decompression surgery. As a sample Deyo et al. suggest that surgical intervention was more successful than conservative treatment for selected patients according to the clinical outcomes and radiological findings.\textsuperscript{10} But the need of fusion after decompression is still unclear. Thomas et al. stated in his study consisting 309 patients that, posterior fusion after decompression did not provide any advantages in degenerative LSCS patients.\textsuperscript{11} In the same way Forsth et al. concluded that adding fusion after decompression did not result in better clinical outcomes than decompression alone.\textsuperscript{12}

Our primary aim was to compare the clinical outcomes and complications between the patients underwent decompressive total laminectomy with and without instrumented posterolateral spinal fusion at 3 years follow-up. Our hypothesis was that satisfactory clinical results can be obtained in LSCS patients who underwent only decompressive laminectomy without fusion, and, naturally, there will be no complications due to instrumentation use.

Materials and Methods

This retrospective study was conducted at the Department of Neurosurgery of the Adıyaman University Education and Research Hospital (Adıyaman–Turkey) between 2011 and 2016 years.

Patients

A total of 102 patients operated due to one or two level LSCS were enrolled in this study. Spinal canal less than 10 mm in MRI axial sectional images was considered as stenosis. Exclusion criteria were previous lumbar spinal surgery, history of severe lumbar spinal trauma, spinal metastasis, concomitant scoliosis, spinal infection, diabetes mellitus, and diagnosis of spondylolisthesis or deformity.

The patients were categorized into two groups: Group 1 consisted of 54 patients who underwent decompression alone, and group 2 consisted of 48 patients who underwent decompression plus posterior transpedicular enstrumanted fusion. Operative time, length of hospital stay, patient characteristics such as age and sex in addition to clinical characteristics such as body mass index were recorded. And change in visual analog scale (VAS), oswestry disability index (ODI) values and presence of adjacent segment syndrome requiring second surgery were compared.

Surgical Technique

After the midline skin incision and subperiosteal dissection of the erector spinae muscles, a standard fenestration laminectomy was performed. Then the ligamentum flavum was resected and the dura was exposed. For cases of severe stenosis or lateral recess stenosis, extensive decompression was performed by a partial undercutting facetectomy but the medial border of the superior facet was usually preserved. And for the instrumanted patients pedicle screws were placed transpedicularly without destruction of the facet joints, and the position of the screws was confirmed by the C-arm. Postoperatively, patients wore a soft lumbar brace for three months. After three months, patients were allowed to return to their normal activities without restriction.

Statistical analysis

Pearson’s chi-squared and t-test were used for statistical analysis. Statistical significance was defined as a $p$ value of less than 0.05. Results were reported as means and standard deviations for numerical variables, and as percentages for categorical data.
Results

As seen in table 1 no significant differences were seen between the groups about number of surgical levels, demographic findings such as age, sex, body mass index (BMI) and length of hospital stay. But there was a significant difference between the groups in terms of mean operation time (125±10.1 min, 217±9 min, respectively, p<0.05).

Table 1. Patient characteristics.

|       | Group 1 | Group 2 | p value* |
|-------|---------|---------|----------|
| n     | 54      | 48      |          |
| Age mean | 67.8(60-71) | 64.3(60-70) | 0.810 |
| Sex   |         |         | 0.701    |
| Male  | 24      | 22      |          |
| Female | 30      | 26      |          |
| BMI   | 29.1    | 30.4    | 0.045    |
| Number of surgical levels (n/%) | | | 0.072 |
| 1     | 40/70.4 | 37/66.9 |          |
| 2     | 14/29.6 | 11/33.1 |          |
| Mean operative time(min.) | 125±10.1 | 217±9.4 | <0.05    |
| Length of hospital stay (day) | 4±1.1 | 6±40.8 | 0.12 |

* chi-squared test

And in both of the groups VAS and ODI scores improved significantly within 3 years. In the group 1 VAS decreased from 9.4 (range from 10 to 7) to 3.02 (range from 4 to 1) and in the group 2 it decreased from 8.7 (range from 10 to 6) to 4.99 (range from 5 to 1). There was no significant difference between the groups in terms of improvement in VAS values (p=0.41).

In the group 1 ODI decreased from 60.9±2.4 to 30.02±5.1 and in the group 2 it decreased from 64.1±1.9 to 35.2±3.2. There was no significant difference between the

Table 2. Comparison of second surgery requirement of the groups.

|       | Group 1 | Group 2 | pvalue* |
|-------|---------|---------|---------|
| Second surgery requirement (n/%) | 4.1% | 9/18.7% | <0.01 |

*chi-squared test

Discussion

This study compared the two types of surgery for LSCS in elderly patients. Patients who underwent only decompression and who underwent posterior transpedicular fusion in addition to decompression were compared for radiological findings and clinical outcomes. The need for surgical intervention in LSCS is still controversial but many studies reported satisfactory recovery in LSCS patients after surgical intervention compared with conservative treatment.10,13 According to our results, patient satisfaction increased after surgery with or without fusion at the end of the third year. Although there was no difference between the two groups, we observed more decrease in VAS and ODI scores in the non-fusion group. Similar to our results in many studies greater back pain was found in the patients underwent decompression plus fusion surgery than patients without fusion.11,14 Also in group 2 we found significantly longer operative time and longer hospital stay although not statistically significant. Thomas et al. found the ratio of undesirable conditions due to surgery and longer operative time in the instrumented group operated due to LSCS.11 Also in their study, Forsth et al. found longer operative time, longer hospital stay and higher complication rate in the instrumented patients.12 And we found second surgery
requirement during 3 years follow-up significantly higher in the group 2. Most of them were due to adjacent segment syndrome. Probably posterior fusion causes changes in the mechanical balance of the spine, eliminates motion so increases the load at the adjacent segments.\textsuperscript{15-17} Review studies on this subject reported that adjacent segment syndrome could be seen radiologically up to 100\%.\textsuperscript{18,19} Some of them become symptomatic and require second surgery so the rate of complications increases in patients and the length of hospitalization increases.\textsuperscript{20} According to the previous studies the incidence of symptomatic adjacent segment syndrome requiring second surgery was ranging from 5 to 18\% and most commonly seen on the cranial side.\textsuperscript{19,21} This difference between results may be because of differences among patient populations and differing methodologies. Some researchers have reported the increased incidence of adjacent segment syndrome according to advancing age.\textsuperscript{22,23} But, in the many previous studies it was reported that there was no association between adjacent segment syndrome and age.\textsuperscript{24,25} In our study no significantly difference was found between age and adjacent segment syndrome. Also Zhong et al. stated that simultaneous decompression at the adjacent segment was one of the risk factors for adjacent segment syndrome.\textsuperscript{19} So damage to the posterior elements appeared to be the most obvious cause.

In this present study there are some limitations. As a sample. The fact that no distinction was made between the two diagnoses; central canal stenosis and lateral recess stenosis. It was a limitation of this study. In addition, the fact that the amount of decompression was not measured postoperatively is another important limitation of this study.

**Conclusion**

We obtained more satisfactory results for both surgeon and patient in patients without fusion. If there is no evidence of serious listesis, total decompressive laminectomy can be performed safely in elderly patients. This successful result may be related to the type of surgery not demographic findings.

Conventional techniques through a minimally traumatic surgical corridor by preservation of spinal stability, optimal visualization, safe well-defined osteotomy lines and adequate decompression of stenotic pathology will ultimately build on achieving improved clinical outcomes. Sodecompression surgery performed up to two levels can be successfully terminated without fusion in elderly population.

**Ethics Committee Approval**

This study was approved by the Erzincan Binali Yıldırım University Medical Faculty ethics committee (2018-9/17) and continued in accordance with the Helsinki Principles Declaration.

**Informed Consent**

All participants signed the Informed Consent Form and their consent was obtained.

**Author Contributions**

Conceptualization, Methodology and writing–original draft: T.Ç., Ş.C.Y. Data curation and investigation: Ş.C.Y. Resources, software, visualization and editing: T.Ç.

**Conflict of Interest**

In this article, there is no conflict of interest between the authors.

**Financial Disclosure**

No financial support is received.

**References**

1. Çelik AA, Çağak S, Kılıç O, Yıldırım A. Bel ağrısı nedeniyle poliklinikimize başvuran hastalarda skolyoz sıklığı ve Cobb açı değerlerinin yaş ve cinsiyet ile ilişkisi. Adıyaman Üniversitesi Sağlık Bilimleri Dergisi, 2017;3(3), 551-564.
2. Dönmez YC, Van Giersbergen MY, Başlı AA, Yıldız MD, Yıldız E. Lomber Disk Hernisi Olan Hastaların Sağlamlığı ve Özyüksüzlik Durumların ve Özelliklerinin Belirlenmesi. Adıyaman Üniversitesi Sağlık Bilimleri Dergisi, 2019;5(2), 1628-1641.
3. Jönsson B, Annertz M, Sjöberg C, Strömqvist B. A prospective and consecutive study of surgically treated lumbar spinal stenosis: part I: clinical features related to radiographic findings. Spine, 1997;22(24), 2932-2937.
4. Truumees E. Spinal stenosis: pathophysiology, clinical and radiologic classification. Instructional Course Lectures, 2005;54, 287-302.
5. Ježek J, Waldau P, Krubec M, Douša P, Skála-Rosenbaum J. Outcomes and Complications of Surgical Treatment for LSS at 1-Year Follow-Up-Prospective Study. Acta chirurgica orthopaedicae et traumatologiei Cechoslovaca, 2019;86(4), 256-263.
6. Kalbaczyk A, Lukes A, Seiler RW. Surgical treatment of lumbar spinal stenosis in the elderly. Acta Neurochirurgica, 1998;140(7), 637-641.
7. Machado GC, Ferreira PH, Yoo RJ, Harris IA, Pinheiro MB, Koes BW, Ferreira ML. Surgical options for lumbar spinal stenosis. *Cochrane Database Syst Rev* 2016;11:CD012421.

8. Ciol MA, Deyo RA, Howell E, Kreif S. An assessment of surgery for spinal stenosis: time trends, geographic variations, complications, and reoperations. *J Am Geriatr Soc* 1996;44:285–90

9. Taylor VM, Deyo RA, Cherkin DC, et al. Low back pain hospitalization: recent United States trends and regional variations. *Spine* 1994;19:1207–13.

10. Deyo RA, Martin BI, Kreuter W, Jarvik JG, Angier H, Mirza SK. Revision surgery following operations for lumbar stenosis. *J Bone Joint Surg Am* 2011;93:1979–86.

11. Thomas K, Faris P, McIntosh G, Manners S, Abraham E, Bailey CS, Manson NA. Decompression Alone vs Decompression plus Fusion for Claudication Secondary to Lumbar Spinal Stenosis. *The Spine Journal* 2019;10(10):1633-1639.

12. Firth P, Olafsson G, Carlsson T, Frost A, Bongstorf M, Fritzell P, Sandén B. A randomized, controlled trial of fusion surgery for lumbar spinal stenosis. *N Engl J Med* 2016;374:1413–23.

13. Herkowitz HN, Kurz LT. Degenerative lumbar spondylolisthesis with spinal stenosis. A prospective study comparing decompression with decompression and intertransverse process arthrodesis. *J Bone Joint Surg Am* 1991;73:802–8.

14. Demiröz S, Bayram S, Coskun T, Cırakli A, Yaniş HS, Atıcı Y, Erdem Ş. Evaluation of the distal adjacent segment after longsegment posterior instrumentation and fusion for adolescent idiopathic scoliosis. *Annals of Medical Research* 2019;26(10):2134-8.

15. Amundsen T, Weber H, Nordal HJ, Magnaes B, Abdelnoor M, Lilieas F. Lumbar spinal stenosis: conservative or surgical management? A prospective 10-year study. *Spine* 2000;25(1):1424-25.

16. Weinstein JN, Tosteson TD, Lurie JD, Tosteson AN, Blood E, Hanscom B, Hilibrand, A. Surgical versus nonsurgical therapy for lumbar spinal stenosis. *New England Journal of Medicine* 2008;358(8):794-810.

17. Çakır T, Çakır M, Okay HÖ, Yolaş C, Tanrıverdi O, Ömeroğlu M, Arslan YK. Single level discectomy with and without disc prosthesis: A comparative study of 114 patients. *Medicine* 2018;97(52).

18. Ilharreborde B, Morel E, Mazda K, Dektoski MB. Adjacent segment disease after instrumented fusion for idiopathic spondylolisthesis: review of current trends and controversies. *Clinical Spine Surgery* 2009;22(7), 530-539.

19. Zhong ZM, Deviren V, Tay B, Burch S, Berven SH. Adjacent segment disease after instrumented fusion for adult lumbar spondylolisthesis: incidence and risk factors. *Clinical Neurology and Neurosurgery* 2017;156, 29-34.

20. Aydin A, Çilingir D. Yeniden Ameliyat Olma (Reoperasyon) ve Hemşirelik Bakımı. *Koç Üniversitesi Hemşirelikte Eğitim ve Araştırma Dergisi* 2017;14(3), 218-222.

21. Park P, Garton HJ, Galu VC, Hoff JT, McGillicuddy JE. Adjacent segment disease after lumbar or lumbosacral fusion: review of the literature. *Spine* 2004;29(17), 1938-1944.

22. Kızılay Z, Topçu A, Aydın YS, Berber O, Ozturk, H. Short and Medium Term Results of Posterior Segmental Instrumentation and Posterolateral Fusion in Female Patients with Spondylolisthesis: A Clinical Trial/Spondylolistezli Kadın Hastalarda Posterolateral Enstrumantasyon ve Posterolateral Fuzyonun Kısı ve Orta Vadeli Sonuçları: Klinik Çalışma. *Meandros Medical and Dental Journal* 2018;19(4), 328-336.

23. Min JH, Jang JS, Joo Jung B, Lee HY, Choi WC, Shim CS, Lee SH. The clinical characteristics and risk factors for the adjacent segment degeneration in instrumented lumbar fusion. *Clinical Spine Surgery* 2008;21(5), 305-309.

24. Ghiselli G, Wang JC, Bhatta NN, Hsu WK, Dawson EG. Adjacent segment degeneration in the lumbar spine. *The Journal of Bone and Joint Surgery* 2004;86(7), 1497-1503.

25. Lee CS, Hwang CJ, Lee SW, Ahn YJ, Kim YT, Lee DH, Lee MY. Risk factors for adjacent segment disease after lumbar fusion. *European Spine Journal* 2009;18(11), 1637.