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Effectiveness of Single Posterior Decompressive Laminectomy in Symptomatic Lumbar Spinal Stenosis: A Retrospective Study

Semptomatik Lumber Spinal Stenoz Hastalarında Posterior Dekompresif Laminektominin Etkinliği: Retrospektif Bir Çalışma

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ABSTRACT

AIM: The best method for surgical intervention in symptomatic lumbar stenosis is not clear. The present study aims to assess first year outcomes and complication rates of patients treated with single posterior decompressive laminectomy.

MATERIAL and METHODS: Patients requiring surgery for severe, symptomatic, lumbar spinal stenosis were evaluated retrospectively. Oswestry disability index scores as well as the complications attributable to surgery were recorded before, at the sixth month and at the twelfth month of the surgery.

RESULTS: Eighty patients were enrolled to the study. The mean age of the population was 63,14 ± 11,57. Neurogenic claudication was the most common finding (65%). Of the patients, 67.5% had severe spinal stenosis. The mean ODI score at the baseline was relatively high than in the literature and was measured as 74.30 ± 5.38. At the end of the 6 months follow-up period, all patients' ODI scores significantly improved. Moreover, this improvement continued till the end of the 12 month. The mean change in ODI at the end of the first year was 41.80% ± 12.73.

CONCLUSION: In selected cases of symptomatic lumbar spinal stenosis, single posterior decompression using laminectomy is safe and effective.

KEYWORDS: Lumbar spinal stenosis, Oswestry disability index, Spinal stenosis

ÖZ

AMAÇ: Semptomatik lumber stenoz için cerrahi girişimin en iyi yöntemi açık değildir. Mevcut çalışma tek posterior dekompresif laminektomi ile tedavi edilen hastalarda bir yıllık sonuçları ve komplikasyon oranlarını değerlendirmeyi amaçlamaktadır.

YÖNTEM ve GEREÇLER: Şiddetli, semptomatik lumbar spinal stenoz için cerrahi gereken hastalar retrospektif olarak değerlendirildi. Oswestry maluliyet indeksi (ODI) skorları ve ayrıca cerrahiyle ilişkili olabilecek komplikasyonlar cerrahiden önce, altıncı ayda ve on ikinci ayda kaydedildi.

BULGULAR: Çalışmaya seksen hasta kaydedildi. Popülasyonun ortalama yaşı 63,14 ± 11,57 yıldı. En sık görülen bulgu nörojenik kladikasyondu (%65). Hastaların %67,5'inde şiddetli spinal stenoz vardı. Başlangıçta ortalama ODI skoru literatürdekinden nispeten yüksekti ve 74,30 ± 5,38 olarak ölçüldü. 6 aylık takip döneminin sonunda tüm hastaların ODI skorları belirgin ölçüde düzeldi. Ayrıca bu düzelme 12. ayın sonuna kadar devam etti. Birinci yılın sonunda ortalama ODI değişikliği %41,80 ±12,73 şeklindeydi.

SONUÇ: Seçilen semptomatik lumbar spinal stenoz vakalarında laminektomi kullanarak tek posterior kompresyon güvenli ve etkindir.

ANAHTAR SÖZCÜKLER: Lumber spinal stenoz, Oswestry malüliyet indeksi, Spinal stenoz

INTRODUCTION

In the older population, lumbar spinal stenosis is the most common indication for spine surgery. Parallel to the increase in the availability of medical technological tools such as magnetic resonance imaging and computerized tomography, the incidence of these surgeries also increases (5).

Conservative treatment, decompression of various types and surgical fusion with or without instrumentation are the management options for this common problem.

Older population with spinal stenosis is more complicated than younger counterparts since the older population may harbor additional co-morbidities which may seriously complicate the surgical intervention. Complex procedures such as instrumented fusion already harbor severe complications and performing these surgeries on older adults necessitates a thorough evaluation of surgical benefits and risks. More complex procedures are associated with greater complications, mortality, and economical burden. It seems that the choice of procedure is more important in older population requiring surgical intervention (6).

This retrospective study aims to investigate the effectiveness and safety of single decompression in selected cases with lumbar spinal stenosis.

MATERIAL and METHODS

From January 2002 to December 2008 586 patients were operated by the senior author (MK) due to lumbar pathologies in Department of Neurosurgery at Gazi University Faculty of Medicine, Ankara, Turkey. Patient charts, surgical dictations, radiological investigations and clinical follow-up data of the patients were reviewed retrospectively. Criteria to include or exclude for analysis were defined as follows:

Inclusion Criteria

- Patients with symptoms related to lumbar spinal stenosis together with radiological signs of stenosis that have completed at least 6 months of unsuccessful conservative management.
- Patients that have documented clinical outcome data (Oswestry Disability Index) prior to the surgery and at the 6th and 12th month of the surgery.

Exclusion Criteria

- Patients with significant radiological instability as proved by dynamic X-rays
- Patients with significant bulging or herniated disc, spondylolysis, spondylolisthesis, polyneuropathy and vascular insufficiency in the lower extremity
- Patients with a history of a previous lumbar surgical intervention

Radiological Evaluation

Patients' radiological images including computerized tomography scans, flexion-extension radiographs and magnetic resonance images were reviewed by a neuro-radiologist blinded to the study and lumbar canal diameter was assessed. For radiological evaluation, T2-weighted axial MR sections were used to assess the lumbar canal diameter. Anterior-posterior canal diameter between 13 – 10 mm was recorded as mild stenosis and 10 – 7 mm as moderate stenosis. Values smaller than 7 mm were considered as severe stenosis.

Surgical Procedure

All of the patients were operated by the same senior surgeon (MK). After induction of general anesthesia all patients were placed in knee-elbow position. A midline skin incision was made over the relevant segment which was determined by fluoroscopy. A subperiosteal dissection of the paravertebral musculature from the spinous process and lamina was achieved by blunt dissection and monopolar cautery. Meticulous hemostasis was achieved with bipolar coagulation. Lateral extend of the dissection included only the lamina of the relevant segment. Facet articulations were left untouched. A control fluoroscopy is obtained and stenotic level(s) are exposed with self-retaining retractors. A surgical microscope is introduced at this part of the operation. Using high-speed electrical drill (Midas Rex) and rongeurs of various sizes a total laminectomy was performed. Careful attention was exercised to preserve facet joint integrity and to prevent iatrogenic instability. In cases with lateral recess stenosis and nerve root compromise, medial facet trimming was performed by the undercutting method using angled Kerrison rongeurs. The ligamentum flavum and spinous processes were completely removed. The operation is ended by the judgment of the performing surgeon after satisfactory decompression of the thecal sac and the nerve roots. After hemostasis, muscles, fascia and skin are closed in standard fashion. None of the patients received discectomy and no attempt was utilized for any sort of fusion or stabilization.

Measurement of ODI

Oswestry Disability Index is a simple, condition specific, multidimensional tool with the advantage of easy patient comprehension and compliance (7). The Turkish version of the questionnaire was validated in 2004 by Yakut et al (18).

Patients were asked to fill the questionnaire the day before their surgery and at 6th and 12th months. They were not aware of the scoring of the questionnaire, nor did they see their previous scores on follow-up. The mean ODI scores at each time period as well as the change in ODI scores were calculated (13):

Statistical Analyzes

Statistical analyses were performed using SPSS (version 16.0, SPSS Inc., Chicago, IL). Baseline, 6th month and 12th month results were compared with paired *t* tests. The results were expressed as mean ± standard deviation. Paired *t* test was used for comparing repeated measures. Analysis of variance was used to compare mean ODI scores and changes in ODI scores between subgroups. Statistical significance was considered for p values smaller than 0.05.

RESULTS

A total of 80 patients were enrolled for this retrospective study. Mean age of the patient population was 63.14 ± 11.57 (ranging from 38 to 90). There were 47 (58.8%) females and 33 (41.2%) males. Table I presents characteristics of the patient population. The most common neurological sign was neurogenic claudication observed in 52 (65%) of the patients. Fifty-three percent of the patients had complaint duration more than 12 months. The level of most severe stenosis was observed in L4L5 segment in 42 (52.5%) patients. Fifty seven (71.2%) had single level stenosis requiring surgery. Of the patients, 54 (67.5%) had severe stenosis described as anterior posterior canal diameter smaller than 7 mm. Table II demonstrates patient characteristics regarding clinical and radiological features.

Mean operation time for the cohort was measured as 77.65 ± 20.89 min (ranging from 45 min to 135 min). The mean hospital stay was 2.45 ± 1.17 days (ranging from 1 to 6 days). In 5 (6.2%) of the patients we observed wound hematoma while there were 4 (5%) unintended dural laceration. All of these patients

responded to intraoperative repair and bed rest without any further intervention. Two (2.5%) patients suffered from additional neurological deficits during the early postoperative period. Foot drop was the main problem in both patients. One resolved 6 weeks after the procedure with the help of conservative treatment, while the other did not resolve. We observed iatrogenic instability in 2 patients (2.5%) at the end of the follow up period. Both of these patients were obese patients harboring additional comorbidities operated due to severe, three level stenosis. One of these patients responded to conservative treatment, while the other required a further stabilization procedure. Table III demonstrates preoperative and postoperative findings of the patients.

Table I: General Characteristics of Patient Population

Parameter	Mean ± SD / N (%)
Age	63.14 ± 11.57
Gender	
Female	47 (58.8)
Male	33 (41.2)
Marital Status	
Single	4 (5.0)
Married	60 (75.0)
Divorced	4 (5.0)
Partner Dead	12 (15.0)
Educational Status	
Primary	42 (52.5)
Secondary	16 (20.0)
High School	8 (10.0)
University	1 (1.2)
None	13 (16.2)
Employment Status	
Active Worker	18 (22.5)
Disabled	29 (36.2)
Retired	33 (41.2)
Body Mass Index	29.87 ± 3.49
Body Mass Index (Categorized)	
Low Weight	1 (1.2)
Normal Weight	10 (12.5)
Overweight	31 (38.8)
Obese	38 (47.5)
Coexisting Medical Disorder	
HT	24 (30.0)
DM	22 (27.5)
Cardiac	10 (12.5)
GIS	3 (3.8)
Depression	9 (11.2)
Pulmonary	3 (3.8)
Multiple	2 (2.4)
ASA Score	
ASA 1	34 (42.5)
ASA 2	34 (42.5)
ASA 3	12 (15.0)

The mean baseline ODI score of the patient population was 74.30 ± 5.38. The mean ODI score measured at the 6th month follow up and 12th month follow up was 49.7 ± 9.52 and 42.98 ± 8.80, respectively. The improvement from baseline to both 6th and 12th month in mean ODI scores was statistically significant (p<.0001). The change in ODI score was 32.8% ± 13.21 during the first 6 months and was 41.80% ± 12.73 at the end of the first year. The improvement in ODI scores was statistically significant (p<0.0001).

Change in baseline ODI scores at the end of the 6th month did not significantly differ between patients regarding number of levels requiring surgery (p=0.895), severity of stenosis (p=0.070), preoperative ASA score (p=0.631), patient gender (p=0.754) or body mass index (p=0.874).

DISCUSSION

As the age of population increases, lumbar spinal stenosis becomes a frequent reason of disability. The pathology can be defined as narrowing of the spinal canal, the lateral nerve root canal or the intervertebral neural foramina due to progressive hypertrophy of any of the surrounding osteocartilaginous and ligamentous elements, and may result in neurogenic or vascular compression of the contents of the spinal canal or vascular compression of the contents of the spinal canal at one or more levels (1,14).

Table II: Patient Characteristics Regarding Neurological Findings and Lumbar Pathologies

Parameter	N (%)
Findings (Signs)	
Neurogenic Claudication	52 (65.0)
Positive SLR / FNT	10 (12.5)
Dermatomal Pain	8 (10.0)
Asymmetric Reflexes	2 (2.5)
Motor Weakness	8 (10.0)
Symptom Duration	
Less than 6 months	3 (3.8)
Between 6-12 months	34 (42.5)
Between 12-24 months	40 (50)
More than 24 months	3 (3.8)
Level of Most Severe Stenosis	
L2 L3	6 (7.5)
L3 L4	32 (40.0)
L4 L5	42 (52.5)
Number of Stenotic Levels Requiring Surgery	
One Level	57 (71.2)
Two Levels	20 (25)
Three Levels	3 (3.8)
Severity of Stenosis	
Mild	12 (15.0)
Moderate	14 (17.5)
Severe	54 (67.5)

Table III: Peroperative and Postoperative Findings of the Patients

Parameter	Mean ± SD / N (%)
Operation Time	77.65 ± 20.89 min
Operation Time	
< 60 minutes	14 (17.5)
60 – 90 minutes	48 (60.0)
90 – 120 minutes	15 (18.8)
>120 minutes	3 (3.8)
Blood Loss	
< 500 ml	25 (31.2)
500 – 1000 ml	50 (62.5)
1000 – 2000 ml	5 (6.2)
Procedure Related Complications	
None	69 (86.2)
Wound Hematoma	5 (6.2)
Additional Neurological Deficit	2 (2.5)
Unintended dural laceration	4 (5.0)
Hospital Stay	2.45 ± 1.17 days
Long Term Complications	
None	70 (87.5)
Iatrogenic Instability	2 (2.5)
Recurrence of Symptoms	4 (5.0)
Wound Infection	4 (5.0)

In this study, the authors present the results of a 1-year follow-up of decompressive laminectomy without fusion for symptomatic spinal canal stenosis. The results demonstrated that all the patients in the cohort benefit from the surgical intervention and this benefit did not deteriorate throughout the first year of follow-up. We know that results of the single decompression usually deteriorate after the first 5 years and only 52-70% of the patients demonstrate excellent or good results (9-12). On the other hand studies demonstrate favorable results during the first years of follow – up. These studies strongly suggest one or the other form of surgical intervention for symptomatic lumbar stenosis (2,15-17). Thinking of the better results of the surgically treated patients than the patients that received conservative therapy, it is obvious that surgery should be performed for severe spinal stenosis but "which surgery?" remains as the difficult question. Planning surgery for spinal canal is a tricky decision to make for a spine surgeon. There is no consensus on the type of surgery for pain relief in spine pathologies (6).

Posterior decompression – total or partial laminectomy and laminotomy- is considered as the first choice of surgical therapy for spinal stenosis in the older population; however, the necessity of a fusion procedure over a decompression is still debatable. While some studies have demonstrated better results in favor of fusion procedures in patients suffering from degenerative spondylolisthesis (3), others have advocated simple posterior decompression would be sufficient (8).

The decision to perform a complex surgery for spinal pathologies has important consequences due to potentially serious complications of such surgeries. In their retrospective cohort study, Deyo et al have demonstrated that the overall mortality of single decompression and complex fusion procedures are 0.3% and 0.6%, respectively. Similarly, there is almost two fold increase in major medical complication (cardiopulmonary or stroke) rates and wound complication rates in complex fusion procedures (6). The complication rates together with favorable outcome measures demonstrated in this study proves effectiveness of single posterior decompression. The evidence supporting the use of decompression is sound, but the indications for instrumentation and fusion aside from coexisting spondylolisthesis and scoliosis are still controversial (4,5) .

The presented study targets the patient population requiring total laminectomy for their severe spinal stenosis leading to low back problems. Whenever possible, less destructive procedures such as bilateral hemilaminectomy should be considered in order to prevent future problems. The main drawback of the current study is the short period of follow-up. The institution in which the study is carried out – Gazi University Faculty of Medicine - is a tertiary referral central that serves virtually to the entire country. The patient population of the hospital constitutes mostly from low socio-economic segment of the Turkey. Unfortunately, most of the patients of this study have recruited from other cities of the country and reaching them for follow – up is very difficult. That is the main reason for the short follow up presented in this study.

CONCLUSIONS

Decompressive laminectomy without spinal fusion is the main surgical intervention for degenerative spinal stenosis in authors' clinic. The results of the current study support the benefits of single decompression in elderly people. Preventing older patient population requiring spinal intervention from complications of extensive surgery is important and short term benefit of the single posterior decompression in lumbar spinal stenosis is promising.

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