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ADDITION OF MICRODISCECTOMY IN LUMBAR SPINAL STENOSIS AND RETROSPECTIVE ASSESSMENT WITH RESULTS OF SAME SURGEON

Ozan Ganiüsmen
Assistant professor,Gözde hospital İzmir,Turkey
Corresponding Author: Ozan Ganiüsmen,Gözde Hospital Departmant of Neurosurgery.
Adress:Gaziler cad.353/4 Yenişehir ,İzmir,Turkey
E-mail:ganiusmen@hotmail.com; Tel:+905424129505 Fax:+90234582020

Abstract
Background: Lumbar Spinal Stenosis is defined as stenosis of spinal canal, lateral reses or neural foramen. The objective of the study is to obtain recovery and complication results gained after the same surgeon carried out in posterior decompression and posterior intstrumentation operations in lumbar spinal stenosis.
Material-Method: Records of patients, to whom posterior decompression with intstrumentation was applied upon lumbar spinal stenosis between January 2013 and December 2014, have been examined retrospectively. During 3rd month controls, VAS, ODI values and claudication, neurological deficit remission, increase in walking distance, complication, reoperation results have been evaluated. Improvements in patients to whom microdiscectemy was applied have been evaluated separately.
Results: In lumbar spinal stenosis, ODI and VAS remissions in the 3rd postoperative month have been found statistically significant. Results in kind were also available for patients added with microdiscectemy. Increases in walking distance were statistically significant in improvements in neurological deficit.
Discussion: Results of recovery and complication are considered as in compliance with the literature. Obtaining the results from cases carried out by same surgeon increases the value of retrospective study.
Conclusion: In lumbar spinal stenosis cases, large posterior decompression and stabilisation, in which microdiscectomy is added, is a highly beneficial treatment method.
Keywords: Decompression,Microdiscectomy, Lumbar spinal stenosis.

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Introduction

Lumbar spinal stenosis (LSS) is a clinical picture occurring due to stenosis of spinal canal, nerve root canals and neural foramen by bone and soft tissue (Kuittinen *et al.,* 2012; Ghobrial *et al.,* 2015; Liang *et al.,* 2015). Such stenosis generally occurs due to osteofits resulting from degeneration of facet and intervertebral articulars or thickening in ligementous structure.

Characteristic findings of LSS include waist, leg pains and neurogenic claudication. Neurogenic claudication occurs due to ischemia developing as a result of compression of neural or vascular structures. Moreover, it has been shown that cauda equina stenosis causes demyelination in nerve roots experimentally (Silvers *et al.,* 1993; Ghobrial *et al.,* 2015).This might be the reason of continuous pain (Kuittinen *et al.,* 2012). Clinical prognosis in LSS is the form of decrease in life quality and increase in dependence to others. Optimal treatment type has not been determined yet in LSS.

Treatments such as activity restriction, posture organisation and steroid injections are beneficial for mild LSS symptoms. Decompressive surgical is indicated in neural damage risk, resistive radicular symptoms, neurogenic claudication and severe stenosis. There are publications stating different results about restricted or large decompression, fusion and instrumentation among surgical treatment methods; however, there are still debates ongoing about which method is more satisfactory Spivak, 1998; Ghobrial *et al.,* 2015; Liang *et al.,* 2015).

The objective of this study is to obtain recovery and complication values of early surgical results of the experienced same surgeon (the author) in operations carried out by large decompressive laminectomy and posterolateral instrumentation technique, and to contribute to the ongoing debates.

Material and method

Records of patients to whom posterior decompression with instrumentation (IPD) was applied upon LSS diagnosis between January 2013 and December 2014, have been examined retrospectively. Neorogenic claudication was a criterion searched in all patients. Serious radicular pain, waist pain, neurological deficit, constant use of painkillers, not benefiting from conservative treatment (at least 3-month physical treatment, bed rest and medicine treatment) and patients complying with LSS radiologically (Magnetic Resonance Imaging and Computerised Tomography) have been effective in determining the surgical indication. Our LSS definition includes degenerative disc hernia, facet articular and ligamentous flavum hypertrophy, spondylolisthesis caused lumber degenerative stenosis. All patients of 112 had central stenosis, but no distinction could be made as foraminal and extraforaminal stenosis. LSS patients with extrude disc hernia have been excluded from the study.

Neurological and radiological examinations have been applied to all patients. For waist and/or hip pain, 10-point visual analogue scale (VAS) evaluation has been applied. Functional disability has been evaluated by using Owestry disability index (ODI). The change in preoperative values of VAS and ODI in all patients was evaluated at the third postoperative month .Recovery of neurological deficits and recovery of neurogenic claudication, complication rates have been detected. In the study group, ODI and VAS improvement of patients to whom additional microdiscectomy was applied due to lumbar disc hernia has been evaluated separately and compared with improvement of patients to whom microdiscectomy was not applied.

All surgeries and follow-up were done in a hospital where approximately 600 spinal operations per year were performed by the same surgeon (author) with long-term spinal surgery experience.

Statistical Analysis Method: Statistical analyses were performed using the Rstudio software version 0.98.501 via R language. The variables were investigated using visual (histograms, probability plots) and analytical methods (Kolmogorov-Simirnov/Shapiro-Wilk test) to determine whether or not they are normally distributed. Descriptive analyses were presented using means and standard deviations for variables-parameters (ODI and VAS). Since the variables were not normally distributed; nonparametric tests were conducted to compare these parameters. The Wilcoxon test was used to compare the change.

Surgical Technique

While the patient was under general anaesthesia and prone position, transpedicular screws were placed in vertebras, determined beforehand, by using C-armed x-ray device after exploration by classical methods. In MRI imaging complying with the clinic before the operation, at least one distance below and above of the stenosis have been included in decompression. Microdiscectomy was applied to patients who have disc hernie after large laminectomy, ligamentum flavum excision, large median facetectomy, large foraminotomy. By observing dura and roots were relieved, posterolateral instrumentation system was completed by placing rods and interconnection (Figure 1). When necessary, erythrocyte and thrombocyte suspensions were used for the patients. 1 gr cefazolin was applied to all patients before the operation. During postoperative period, cefazolin and metronidazol application continued for 1 week. Analgesics were applied according to pain complaints. The patients without complication have been discharged on the second day.

Results

Out of 112 patients, who were operated, 36 patients were male and 76 patients were female. The average age was 62.1 (28-81). All patients had functional restriction due to waist and/or hip pain, and all patients had neurogenic claudication (NC). Pre-operative duration of the symptoms differs between 3 months and 10 years. L3-4 (47 patients-41%) and L4-5 (91 patients-80%) are the most frequently observed stenosis distances. While the average of waist, hip and/or leg pain was 8.3 during pre-operation period according to VAS score ten-point evaluation, such figure changed into 2.2 in the 3rd postoperative month. A significant difference has been found statistically between preoperative VAS and postoperative VAS ($p=0.0001$) (Table 1).

Similarly, while average ODI was 57.6 before the operation, it changed into 11.8. A significant difference has been found statistically between preoperative ODI and postoperative ODI ($p=0.0001$) (Table 1). Preoperative VAS of the patients, to whom microdiscectomy was applied in addition to decompression due to degenerative disc pressure, was 8.0 and the VAS value in the 3rd postoperative month was 1.6. Preoperative average ODI was 54.3, and postoperative ODI was 10.5 in the 3rd month. In comparison of patients to whom microdiscectomy was applied, a significant difference has been found statistically between preoperative VAS and postoperative VAS, and also between preoperative ODI and postoperative ODI ($p=0.0001$) (Table 2).

In the comparison of patients who did not require microdiscectomy, a significant difference has been found statistically between preoperative VAS and postoperative VAS ($p=0.0001$), and also between preoperative ODI and postoperative ODI ($p=0.0001$) (Table 3). In the comparison of ODI and VAS in preoperative and postoperative 3rd month between the group applied microdiscectomy and the group not applied microdiscectomy, no significant difference has been found statistically (Table 4). All patients had neurogenic claudication, and the average walking distance was 145.0 m (10m-400m) before the operation, and such figure was 1970.8 m (300m-6km) after the operation. A significant difference has been found in comparison of walking distances in the 3rd month of postoperative and preoperative periods ($p=0.0001$) (Table 5). 42 Patients had neurological deficit before the operation. During postoperative period, neurological power loss of 22 patients (52%) have been recovered completely, and 14 patients (33%) have been recovered partially. While 5 patients remained the same (12%), in 1 one of the patients there has been an increase in power loss (2%).

Recovery of neurological deficit of patients, who has preoperative neurological deficit, in the 3rd postoperative month has been found statistically significant (χ^2_{Yfever}=24.3, p<0.0001) (Table 6). No patient had incontinence before or after the operation. After surgical interventions, 4 patient had infection (%4) (in the 1st month), 2 patients suffered from pain or increase in pain (2%), 2 patients(%2) had non-preoperative neurological deficit, and 1 patient(%1) had increase in neurological deficit, and 1 patient had BOS fistule (1%). 4 patients were applied re-operation (4%) in the first month for revision purposes; 1 patient due to infection, and 3 patients due to screw malposition.

Table 1. Descriptives Statistics of Groups (Part 1)

Groups	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum
				Lower Bound	Upper Bound		
Group 1	6	4,60	0,18	4,40	4,79	4,38	4,87
Group 2	6	3,70	0,11	3,58	3,81	3,58	3,87
Group 3	6	3,82	0,07	3,74	3,90	3,68	3,87
Group 4	6	4,48	0,20	4,28	4,70	4,24	4,80
Group 5	6	4,70	0,15	4,58	4,90	4,50	4,89
Group 6	6	4,72	0,07	4,63	4,77	4,63	4,80

Table 2. Pre and post comparison of VAS and ODI scores in LHNP (N=21)

Variables	Mean	SD	p-Value *
Pre VAS	8.0	0.9	0.0001
Post VAS	1.6	1.3	
Pre ODİ	54.3	18.1	0.0001
Post ODİ	10.5	11.5	

* Wilcoxon Signed-Rank test has been used.

Table 3. Pre and post comparison of VAS and ODI scores in patients with LHNP (N=91)			
Variables	**Mean**	**SD**	**p-Value** *
Pre_ODI	581	15.4	0.0001
Post_ODI	12.5	13.2	
Pre_VAS	8.4	0.9	0.0001
Post_VAS	2.4	1.5	
* Wilcoxon Signed-Rank test has been used.			

Table 4. Comparison of groups with and without LHNP					
Variables	**LHNP**	**N**	**Mean**	**SD**	**p-Value** *
Pre ODI	Negative	91	58.1	15.4	0.235
	Positive	21	55.2	18.2	
Post ODI	Negative	91	12.5	13.2	0.137
	Positive	21	9.1	10.1	
Pre VAS	Negative	91	8.4	0.9	0.215
	Positive	21	8.1	0.9	
Post VAS	Negative	91	2.4	1.5	0.052
	Positive	21	1.7	1.3	
* Mann Whitney U test has been used.					

Table 5. Pre-Post walking distances comparison			
Variables	**Mean**	**SD**	**p-Value** *
Pre Walking Distance	145.0	96.6	0.0001
Post Walking Distance	1970.8	982.7	
* Wilcoxon Signed Rank test has been applied.			

Table 6. Recovery of neurological deficit

		Preop Neurological Deficit		
		Positive	Negative	Total
Postop recovery	Positive	36	76	112
	Negative	6	106	112
	Total	42	182	224

Figure 1. Operation View

Discussion

Decompression surgery for patients, who could not benefit from conservative treatments, is a golden standard in treatment of central canal or lateral resses stenosis. Instability, occurring due to facet articular resection more than 50%, degenerative spondilisthesis, scoliosis, kyphos, decompression made beforehand, causes fusion requirement (Spivak, 1998; Kuittinen *et al.,* 2012). Modifications such as bileratel laminectomy and unilateral laminectomy and decompression protect structures life spinosis process, interspinosis ligaments that support the medium line, and aim to secure spinal stability (Kwon, 2014; Lee *et al.,* 2015b). Such techniques cause decompression at lateral and central area at surgical level. Sufficient decompression and a good surgical relation have been reported (Lee *et al.,* 2015b). Such approaches include certain technical and theoretical limitations. As structures were not removed in the medium line, it is difficult to reach ipsilateral indentation and foraminal area. Therefore, breach of facet capsule and larger facet articular resection are required for ipsilateral lateral resses and neural foramen decompression.

In addition, sufficient decompression becomes harder in central area. In bilateral decompression, lateral resses to narrow corridor of the counterpart during lamintomy and foremen, and important thecal sac pressure can occur. Risk for nerve and dural injury may occur (Kuittinen *et al.,* 2012).In order to reach sufficient decompression with such techniques, breach of facet capsule is required. Accordingly, such approaches can endanger stability. Certain changes can be applied in these techniques which provide large decompression (Kuittinen *et al.,* 2012). However, these depend upon the experience of the related surgeon and they are not the only method. Insufficient decompression during surgical treatment of narrow tract causes non-elimination of complaints. Surgeons who do not want to experience such kind of a problem tend to apply large decompression. This is the most important reason of instability after operation (Ghobrial *et al.,* 2015; Glassman *et al.,* 2006).

In order to avoid repeated operations and to make sufficient decompression, many surgeons consider IPD as an appropriate method in severe LSS degrees (Ghobrial *et al.,* 2015; Lee *et al.,* 2015b). There are publications which report different results about restricted or large decompression, fusion and instrumentation, and there are still debates ongoing about which method is more satisfactory (Ghobrial *et al.,* 2015; Liang *et al.,* 2015). Glassman *et al.,* (2006), in their multicentral study (5 spinal surgical centres), examined 497 patients, applied five separate surgical operation with and without fusion, and compared them by using "short form 36" (SF 36); no relation has been found between satisfaction after operation (recovery rate) and surgical operation. Silvers *et al.,* (1993), in their study including 244 cases to whom decompressive laminectomy was applied due to LSS, 93% satisfaction has been detected in short term. Regarding fusion, there are no class I studies proving the fusion improve functional outcomes in patients without criteria of instability. However, there are many papers with class II and III evidence levels advocating concomitant spinal fusion and arthrodesis to improve outcomes and avoid late instabilities, even in patients without spondylolisthesis or spinal deformities (Liang *et al.,* 2015).

In a meta-analysis involving 23 trials, decompression and fusion were superior to decompression alone (Deyo *et al.,* 2013; Liang *et al.,* 2015). In the same study, it has been emphasized that different surgeons can affect the accuracy of the result (Deyo *et al.,* 2013; Liang *et al.,* 2015). Our study has been carried out by same surgeon. Potential complications of spinal stenosis surgery include epidural hematoma, thromboemboly, dural tear, infection, instability, nerve root injury, non-union, implant failure and adjacent segment degeneration. Rate of incidence of symptomatic pulmonary thromboemboly after lumbar decompression is 0.05% (Yuan *et al.,* 1994). Iatrogenical dural tear has been given between 1% and 14% in literature; if repaired well, long term BOS penetration and pseudomeningosel do not occur generally (Deyo *et al.,* 1992). Deyo *et al.,* (1992) have reported postoperative deep infection rate as 0.5% (Deyo *et al.,* 1992; Lin *et al.,* 2006).

Addition of arthrodesis into decompression can increase infection rate up to 2-3% (Cavuşoğlu *et al.,* 2007). Nerve root injury can occur due to surgical manipulation in existence of severe stenosis or as a result of instrumentation. In a serial with IPD including 2052 patients, neurological damage occurred in 37 patients (1,9%) (Poletti, 1995). In decompression surgery, Benz *et al.,* (2001) have reported the rate of complication affecting life quality as 12%, and early mortality as 2% (10). Carreon *et al.,* have detected at least one major (%21) and minor complication(%70) in decompensed surgery (Spetzger *et al.,* 1997).

In a study on veteran groups (av. 60 years), 2, 1% major complication and 3, 2% injury problem have been detected (Herron and Trippi, 1989; Diwan *et al.,* 2003). The most frequent reason of failure in spinal stenosis surgery is insufficient decompression; however, symptoms re-occur in 10% and 15% of patients in cases even with well applied decompression (Eismont *et al.,* 1981). Female frequency in our cases is observed in other studies too (Eismont *et al.,* 1981; Benz *et al.,* 2001). VAS and ODI recoveries, complication and reoperation rates in our study are generally seen as in compliance with the literature.

Retrospective evaluations in spinal surgery results can be highly beneficial. Accuracy is higher in weak and good results (Ghobrial *et al.,* 2015; Lee *et al.,* 2015a). Evaluations related to recovery of neurological deficits and increase in claudication distances have statistical significance, but no one-to one similar study was found. We think that evaluation of microdiscectomy contribution provide additional contribution to the literature.

Strong aspects of our studies include the followings: inclusion of many parameters in evaluation, sufficient number of patients, and fulfilment of all operations by the same surgeon (the author). However, limitation of follow up period is the weak aspect of the study.

It is planned to compare long term results with short term results.

We think that IPD is a suitable method in severe LSS cases for case satisfaction, avoidance of repeated operations and sufficient decompression. Microdiscectomy, applied when required, is a part of decompression.

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