TREATMENT OF DEGENERATIVE LUMBAR SPINAL STENOSIS BY DECOMPRESSIVE LAMINECTOMY AND POSTERIOR INSTRUMENTATION*

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ABSTRACT:

The purpose of this study is to evaluate the patients' satisfaction operated because of lumbar spinal stenosis, by decompressive laminectomy, and posterolateral fusion and posterior instrumentation in view of pain relief, walking distance and need for any external support.

Eleven patients had the procedure of decompressive laminectomy, posterolateral fusion and instrumentation between the years of May 1997- June 1998, because of degenerative lumbar spinal stenosis. The mean age at the time of surgical intervention was 62.8 (45-77) years. The average duration of symptoms preoperatively was 8 (4-13) years. In all cases, walking distance was diminished when compared with the previous years. Seven patients had complained of being unable to do even their daily home activities. The other 4 patients stated that their walking distance without low back pain was under 500 meters before the operation. On CT scans, the examination criteria was anteroposterior diameter of spinal channel in the most stenosed level. This value was 9.1 (7-11) in average. Decompressive laminectomy was performed in one level in 2, in two levels in 5, in three levels in 3, and four levels in one patient. The mean follow up period was 21 (18-30) months.

At the last follow- up, walking distance has increased for 8 patients and it was 2000 meters without pain in average. Among 11 patients, low back pain was eliminated in 6, decreased in 2, same in two, and increased in one case. One patient whose pain had increased, needed to use crutches for walking.

Key Words: Lumbar spinal stenosis, spinal instrumentation, posterolateral fusion.

INTRODUCTION

Spinal stenosis is narrowing of the spinal canal, the nerve root canals, or the neural foramina. The narrowing can be caused by the bony or soft tissue elements of the spinal canal or a combination of both (3,19). Degenerative lumbar spinal stenosis is the result of chronic disc degeneration and secondary spinal instability (6).

The timing of surgery is usually based on the patient's decision that his or her quality of life, related to back and leg complaints, is

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unsatisfactory. This frequently occurs in an aged patient, who may have concomitant medical problems (18).

Surgery for degenerative lumbar spinal stenosis is generally performed to improve the quality of life (11). Surgical decompression is the aim of restoration a balance between adequate tissue removal to decompress the neural structures and adequate retension of bone necessary to provide mechanical stability (5). In the majority of patients, surgery can provide relief for leg pain complaints related to spinal stenosis and can be rewarding for both the patient and the surgeon.

The purpose of this study is to evaluate the patients' satisfaction, operated because of lumbar spinal stenosis, by decompressive laminectomy, and/or foraminotomy, posterolateral fusion and posterior instrumentation in view of pain relief, walking distance and need for any external support.

PATIENTS and METHODS

Eleven patients who had undergone decompressive laminectomy, posterolateral fusion and posterior instrumentation because of degenerative lumbar spinal stenosis between May 1997 and June 1998 were evaluated. The mean age at the time of surgical intervention was 62.8 (45-77) years. The average duration of symptoms preoperatively was 8 (4-13) years. Five of the cases were males, and 6 were females.

The operation was suggested for patients; the first is persistent leg pain that interferes with the patient's quality of life (this is related to the patient's activity level, not a proscribed limitation mandated for the entire group). Second is the failure of non operative care to relieve symptoms over a period of at least two to three months. Third is documented spinal stenosis confirmed by computed tomographic scan (CT) and/or a magnetic resonance imaging (MRI) (6,8).

In all cases, walking distance was diminished when compared with the previous years. Seven patients complained of being unable to perform even their daily home activities. Although neurogenic claudication was present in all cases, four patients suffered from back pain and claudication which manifested itself under 500 meters. The symptomatology was particularly significant since the patients presented with severe bilateral root pain in 5 out of 11 cases, intense low back pain requiring strong analgesics in 9 cases out of 11. The three symptoms were often associated together in 9 cases out of 11 and resulted in major functional impairment.

Plain radiographs were obtained in all patients, (Figure 1a,b) and the diagnosis was established by CT scanning or MRI (Figure 2a,b).

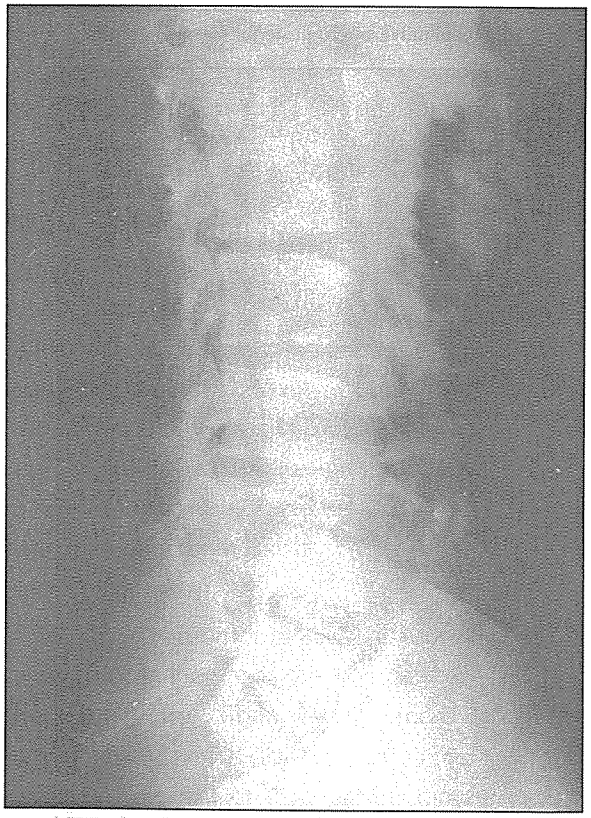

Figure 1. Preoperative lateral roentgenogram.

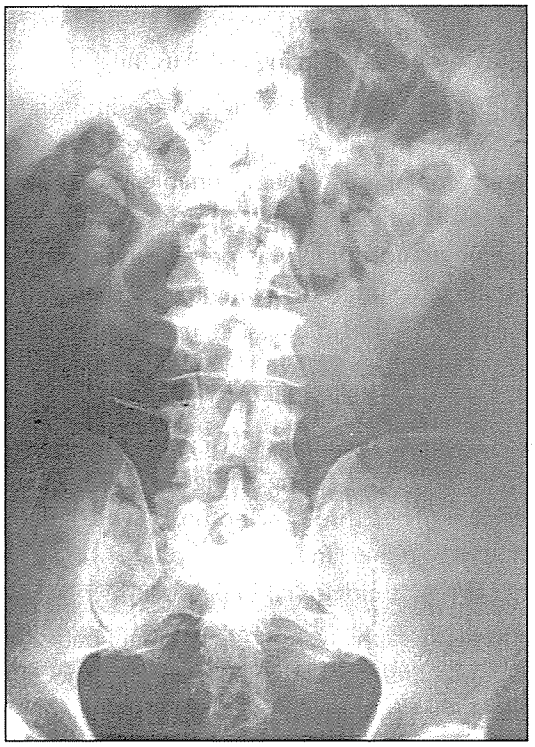

Figure 1b. Preoperative antero-posterior roentgenogram.

Figure 2a. MRI of a patient with degenerative lumbar spinal stenosis.

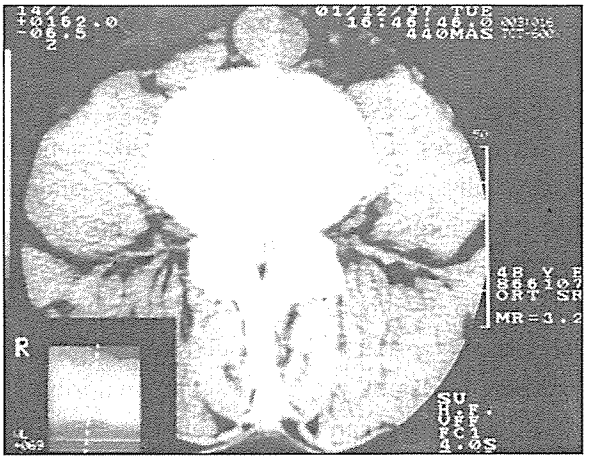

Figure 2b. Computed Tomography of a patient with degenerative lumbar spinal stenosis.

Preoperative assessment of lumbar instability often relies on the comparison of erect lumbosacral flexion and extension x-rays. CT scans were performed in all the cases and these made it possible to determine the extent and site of lateral recesses. Mean value of the anteroposterior diameter of the spinal canal on CT scanning was 9.1 mm (range: 7-11 mm). All patients were evaluated with neurologic examination. These preoperative findings are shown on Table 1.

Table 1. Preoperative and postoperative distrubution of patients according to pain and functional assesment scale

Patient no	Preoperative point	Postoperative 6th month point	Follow-up point
1	10	1	1
2	11	0	0
3	8	10	10
4	10	0	0
5	14	2	1
6	16	3	2
7	12	0	0
8	16	2	1
9	10	1	0
10	14	1	1
11	9	0	0

The surgical procedure consisted of wide release of affected levels with decompressive laminectomy and/or facetectomy, foraminotomy if necessary, posterolateral fusion with autografts

and posterior stabilization. These procedures were performed in all patients. The levels involved were: L2-3-4-5 in one case, L3-4-5 in three cases, L4-5 in five cases, L4 in one case and L5 in one case. Cases with previous back surgery, spondylolisthesis, spondylolysis or arterial insufficiency in lower extremities were excluded from the study.

Pain and functional status of the patients were evaluated with Pain and Functional Assesment (PFA) Scale (14) (Table 2). Fusion and spinal canal narrowing were evaluated with conventional radiograms and CT or MRI.

RESULTS

The mean follow-up period was 21 (18-30) months. Decompression was performed in one level in 2, in two levels in 5, in three levels in 3, and four levels in one patient (Figure 3a,b).

Figure 3a. Postoperative antero-posterior roentgenogram of the same patient after total bilateral laminectomy, posterolateral fusion and posterior instrumentation.

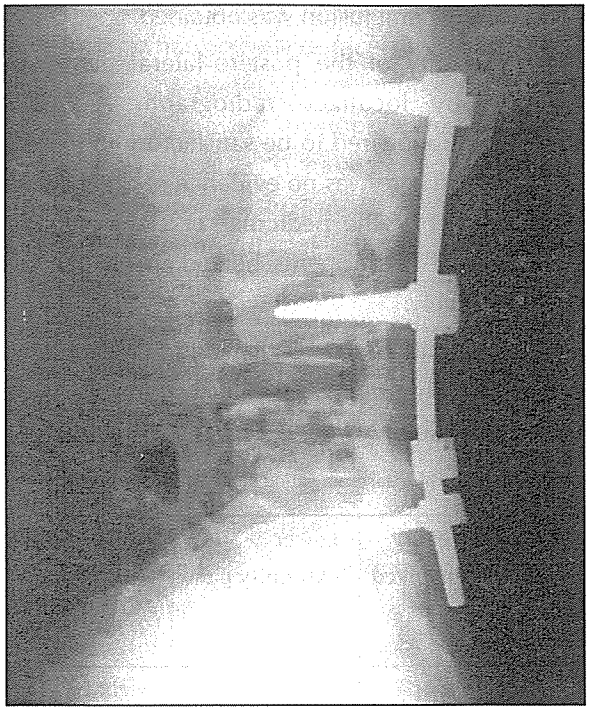

Figure 3b. Postoperative lateral roentgenograms of the same patient after total bilateral laminectomy, posterolateral fusion and posterior instrumentation.

The mean hospitalization period was 12 days. Patients were ambulated in the evening of surgery or in the next morning. If there was a concern with instability, the patients were fitted with a lumbosacral corset. On the last follow-up, walking distance has increased for 8 patients and it was 2000 meters without pain on average. Among 11 patients, low back pain was eliminated in 6, decreased in 2, remained the same in two, and increased in one case. Fusion was not obtained in one patient whose pain had increased; crutches were needed for walking. This patient refused a second operation.

No aggravation of neurological or root lesions was seen but there was one haematoma which did not affect the final result, and one septic complication which was resistant to treatment and required removal of the implant material at the fifth month; this also did not affect the final result

and posterolateral fusion was obtained.

The quality of the postero-lateral graft was assessed by localized radiographs, and CT scanning. It appeared to be satisfactory in ten out of 11 cases. There was no evidence of breakage or displacement of the pedicular or sacral screws. Neurological impairments healed in all patients postoperatively.

Clinical differences of the patients evaluated preoperatively and at the last controls were evaluated with PFA ,values are seen in Table 1.

DISCUSSION

Degenerative lumbar spinal stenosis is the result of chronic disc degeneration, secondary spinal instability, and the body's attempts to control these phenomena. Symptoms may arise during any stage of the degenerative process and depend on mechanical and neurologic factors. These symptoms range from back discomfort or isolated nerve root irritation to frank neurogenic claudication (6,11).

Table 2. Neurological examination of patients

Patient no	Level involved	Lower extremity pain	Sensory deficit	Motor deficit	Anteroposterior diameter of the most stenosed level (mm)	Patellar reflex	Achilles reflex
1	L_4	Right	Right L_{4-5}	None	11	+/+	+/+
2	L_5	Right	Right L_5	None	8	+/+	+/+
3	L_{4-5}	Left	Bilateral L_5	None	10	+/+	+/+
4	L_{4-5}	Left	Bilateral L_5,S_1	Left great toe extension(3)	9	+/↓	+/↓
5	L_{3-4-5}	Bilaterally	Left L_{4-5},S_1	Left drop foot(2)	10	+/-	+/-
6	L_{3-4-5}	Bilaterally	Left L_5,S_1	Left great toe extension(3)	9	+/-	+/-
7	L_{4-5}	Left	Left L_5,S_1	None	10	+/+	+/+
8	$L_{2-3-4-5}$	Bilaterally	Right L_{3-4-5},S_1	Right drop foot	8	-/+	-/+
9	L_{4-5}	Right	Right L_{4-5}	None	9	+/+	+/+
10	L_{3-4-5}	Bilaterally	Left L_{4-5}	Left great toe extension(3)	7	+/↓	+/↓
11		L_{4-5}	Bilaterally	Right L_5,S_1	None	10	↓/+ ↓/+

Surgery for spinal stenosis consists of spinal decompression to remove those elements (bony and tissue) that are compressing the dural sac and nerve roots. The extent of the decompression depends on the specific anatomy of the individual case. The most frequent error is to decompress too little (16). There appears to be a clear-cut consensus that patients who present with clinical symptoms of spinal stenosis and a confirming imaging study should undergo decompression of the involved segment(s) when nonsurgical treatment fails. The expected success rate is between 75% and 90% (7,9).

Deciding which patients would benefit from a concomitant arthrodesis is more difficult. At the time of the decompressive laminectomy, the decision to fuse is based on two factors. The first is the preoperative structural integrity of the lumbar spine. The second takes into account any structural changes that occur during the decompressive laminectomy itself.

The significant preoperative structural alterations are: presence of degenerative spondylolisthesis along with spinal stenosis, scoliosis and/or kyphosis along with spinal stenosis and recurrent spinal stenosis at a previously decompressed spinal level with or without iatrogenic spondylolisthesis.The significant intraoperative changes are: excessive removal of lumbar facet(s) and radical excision of the intervertebral disk at the level of decompression. Abumi et al (1) have demonstrated in cadaveric specimens the importance of the lumbar facet joints for the structural stability of the motion segment. Upon performing progressive facetectomies of the lumbar motion segment and subjecting the specimens to cyclical loading in an Instron machine, they concluded that removal of greater than 50% of each facet joint led to unacceptable movement of that motion segment. Therefore, when excessive facet excision occurs during surgery, posterolateral arthrodesis should be added to prevent postoperative instability. Herkowitz et al (7) have concluded that decompression in the most stenosed level combined with an arthrodesis gave better results than decompression alone. Grob et al (4) have concluded that by preserving the stabilizing posterior elements of the spine, arthrodesis is not necessary after decompression of the lumbar spine. They believe that decompression with simultaneous arthrodesis is indicated only if there are obvious signs of instability, such as iatrogenic instability. In our series, all patients were treated by total laminectomy and/or foraminotomy so, iatrogenic instability was inevitable for these. We were obliged to perform arthrodesis with posterolateral fusion and instrumentation in these cases.

The goals of internal fixation are to correct deformity, to stabilize the spine, to protect the neural elements, to improve the rate of fusion, to reduce the number of segments requiring arthrodesis, and to reduce rehabilitation time. Pedicle fixation appears to solve the technical problems of the traditional implant systems when a spinal instrumentation system is indicated following a decompressive lumbar laminectomy. Pedicle fixation places the fixation points through the lumbar pedicle- the strongest part of the osteopenic vertebrae (2,20). It allows segmental fixation, which improves torsional stability and aids in maintaining lumbar lordosis. Finally, reduction of spinal deformity is accomplished more efficient with pedicle segmental fixation. The incidence of pseudoarthrosis following posterolateral fusion increases with the number of levels being fused. The rates of pseudoarthrosis for

one, two-, and three-level fusions are 3.5% to 10%, 15% to 20% and 25% to 33%, respectively (10). We prefer to use pedicle screw fixation to augment bony fusion. This increases the success rate of fusion, particularly in multilevel fusions.

There have been many reports of the outcome of surgery for spinal stenosis. Turner and colleagues (18) found 74 articles published before September, 1990. They found that an average of 64% of patients were in the good -to-excellent categories after surgery. There was a decrease in the success rate with length of follow-up in most studies (12,15). Success in 75%-90% of cases at two years declined to about 67% at 5 years postoperatively (8). The evaluation criteria of the patients are pain relief in low back and lower extremity, walking distance and need for any support. Katz et al (13) have used the subjective criteria of back and leg pain for the evaluation of their patients suffering from spinal stenosis and they found that decompressive surgery is generally more effective in ameliorating lower extremity symptoms. They concluded that patients with predominance of back symptoms are significantly less satisfied with the results of surgery than the ones with predominance of leg pain. In the study of Tatari et al. (17) the evaluation criteria were pain relief and walking distance. In their studies, walking distance without pain had increased subjectively in 86% pain-satisfied patients. In our study, walking distance without pain had increased subjectively in ten patients.

Decompressive laminectomy for spinal stenosis is usually rewarding for both the patient and the physician in the properly indicated case. Improvement in surgical techniques, anesthetic techniques, and medical care allow this procedure to be carried out safely in patients well over 70 years of age. It should be offered to those patients who are disabled in order to improve their quality of life, in much the same manner that they are offered total hip replacement.

REFERENCES

1.Abumi K, Panjabi MM, Kramer KM, Duranceu J, Oxland T, Crisco J: Biomechanical evaluation of lumbar spinal stability after graded facetectomies.Spine 15:1142-1147,1990

2.Bridwell KH, Sedgewick TA, O'Brien MF, Lenke L, Baldus C: The role of fusion and instrumentation in the treatment of degenerative spondylolisthesis with spinal stenosis. J Spinal Disord 6: 461 ,1993.

3.Epstein NE, Epstein JE: Lumbar Decompression For Spinal Stenosis. In Frymoyer JW, eds. The Adult Spine. Philadelphia, Lipincott-Raven PA, Second Edition, 1997 pp 2055-2133

4.Grob D,Humke T, Dvorak J: Degenerative lumbar spinal stenosis. J Bone Joint Surg 77-A:1036-1041,1995

5.Grobler L, Robertson P, Novotny J, Pope M: Decompression for degenerative spondylolisthesis and spinal stenosis. Spine 18:1475-1482,1993

6. Hanley EN: The surgical treatment of lumbar degenerative disease. Spine, Orthopaedic Knowledge Update. Am Acad of Orthop Surg 127-141, 1997

7.Herkowitz HN, Kurtz LT: Degenerative lumbar spondylolisthesis with spinal stenosis:A prospective study comparing decompression and intertransverse process arthrodesis. J Bone Joint Surg 73A: 802-808,1991

8-Herkowitz HN: Surgical management of spinal stenosis. American Academy of Orthopaedic Surgeons 65th Annual Meeting Instructional Course Lecture No 21, New Orleans,1998

9.Herron LD, Mangelsdorf C: Lumbar spinal stenosis: Results of surgical treatment. J Spinal Disord 4: 26-33,1991

10.Jackson RK, Boston DA, Edge AJ: Lateral mass fusion: A prospective study of a consecutive series with long-term follow-up. Spine 10: 828-832,1985

11.Johnsson KE, Rosen I, Uden A: The natural course of lumbar spinal stenosis. Clin Orthop 279: 82-86,1992

12.Katz JN, Lipson SJ, Larson MG, McInnes JM, Fossel AH, Liang MH: The outcome of decompressive laminectomy for degenerative lumbar stenosis. J Bone Joint Surg 73A: 809-816,1991

13.Katz J, Lipson SJ, Brick GW, Brobler L, Weinstein J, Fossel A, Lew R, Liang M: Clinical Correlates of patient satisfaction after laminectomy for degenerative lumbar stenosis. Spine, 20: 1155-1160, 1995

14.Kray MH: Spinal fusion. Overview of options and posterior internal fixation devices. The Adult Spine. Edited by JW Frymoyer. New York, Raven Press, 1991 pp1919-1934

15.Silvers HR, Lewis PJ, Asch HL: Decompressive lumbar laminectomy for spinal stenosis. J Neurosurg 78: 695-701,1993

16.Suzuki K, Takatsu T. Inoue H, Teramoto T, Ishida Y, Ohmori K: Redundant nerve roots of the cauda equina caused by lumbar spinal canal stenosis. Spine 17:1337-1342,1992

17.Tatari H, Bozkurt M, Boya H: Treatment of degenerative lumbar spinal stenosis by total bilateral laminectomy, posterolateral fusion and posterior instrumentation. J Turk Spin Surg 8(3): 106-112,1997

18.Turner JA, Ersek M, Herron L, Deyo R: Surgery for lumbar spinal stenosis:attempted meta-analysis of the literature. Spine 17: 1-8,1992

19.Vebiest H: Result of Surgical Treatment of Idiopathic developmental Stenosis of the Lumbar vertebral canal. A review of 27 years' experience. J Bone Joint Surg 59-B: 181-188, 1977

20-Zindrick MR, Wiltse LL, Widel EH, Thomas JC, Holland WR, Field BT, Spencer CW: A biomechanical study of intrapeduncular screw fixation in the lumbosacral spine. Clin Orthop 203: 99-112,1986

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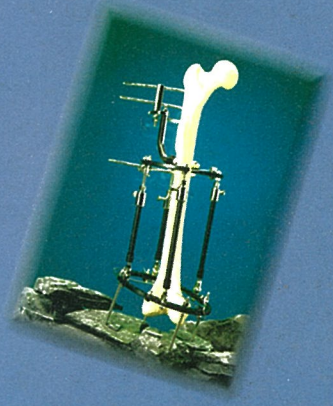

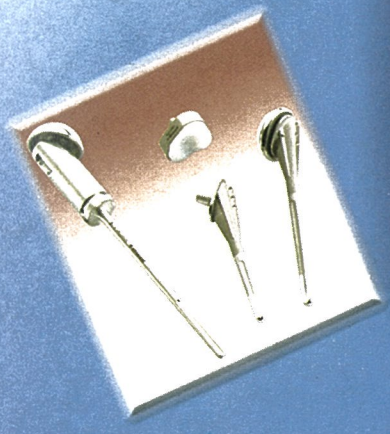

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