

A NEW METHOD OF SURGICAL TREATMENT OF LUMBAR SPINAL STENOSIS

TOSHISUKE SAKAKI, TETSUYA MORIMOTO and SHOZABURO UTSUMI

Department of Neurosurgery, Nara Medical University

SEIJI MIYAMOTO and KAZUO OKUCHI

Department of Emergent Medicine, Nara Medical University

SHIGERU TSUNODA and KAZUO GODA

Department of Neurosurgery, Saiseikai-chuwa Hospital

KIYOSHI TAKEMURA

Department of Neurosurgery, Osaka Prefectural Hospital

SHOJI INUI

Department of Neurosurgery, Nara National Hospital

Received January 17, 1990

Summary: As the treatment of lumbar or lumbosacral stenosis, laminectomy with the preservation of tissues supporting the spine and the embracement of the exposed dura mater with thin silicone rubber to prevent the occurrence of restenosis due to exuberant fibrous tissue formation at the operative site have been performed over a period of seven years. Before the prevention of restenosis with silicone rubber, we had to reoperate in cases which developed recurrent symptoms resulting from restenosis of the lumbosacral canal. This operation that we describe is technically feasible and with practical benefit can be done routinely for spinal decompression not only in the lumbosacral, but also in cervical spinal region without requiring an extensive laminectomy.

Index Terms

lumbosacral stenosis, surgical decompression, silicone rubber

INTRODUCTION

Lumbosacral spinal stenosis has been recognized as an important cause of low back pain of the lower extremities, and motor weakness of the lower extremities. The surgical treatment of these conditions has consisted of a wide decompressive laminectomy, and a foraminotomy in case of necessity, for the purpose of relief of symptoms resulting from spinal and foraminal stenosis. With such a therapy, results are gradually excellent and it is possible to get a good postoperative outcome in more than 90% of cases⁽⁴⁾⁽⁵⁾⁽¹⁶⁾⁽¹⁷⁾. Major complications resulting from these procedures are unusual. Therefore, decompressive laminectomy is the treatment of choice in most patients with lumbosacral stenosis.

In the long follow up studies of decompressive lumbosacral laminectomy, the late recurrence rate may be as high as 30% in spite of a good result soon after operation⁹⁾¹²⁾¹⁵⁾. Causes of late recurrence of symptoms are the late development of spinal instability secondary to wide laminectomy⁹⁾¹⁰⁾¹⁷⁾, and restenosis due to exuberant fibrous tissue formation at the operative site¹²⁾.

From these points of view, we have performed a preservation of the posterior structure and retained the integrity of the motion segment, and performed an embracement of the dura mater of the surgically exposed area with silicone rubber.

SURGICAL TECHNIQUE

At first, a laminectomy was performed by incising the lumbosacral fascia on both sides of the supraspinous ligament. The muscles were separated from their tendinous attachments to the spine and laminae without, as far as possible, removing the interspinous ligaments and muscles. After this procedure, the spinous processes of the spines were undercut with a surgical air drill, keeping them incorporated in the supraspinous ligament. If the supraspinous length incised was too short to be retracted to the side, it was left in mid-portion. Furthermore, if it was not possible to get adequate exposure of the spinal laminae as a result of the preservation of the supraspinous ligament, the tips of supraspinous processes of the spine in the caudal and rostral side of the area to be decompressed, were also undercut, and by this surgical procedure, further retraction of the supraspinous ligament became possible without excessive stress.

Next, the removal of the posterior neural arch of the affected spine was performed by transection of the pars interarticularis bilaterally. After removal of the arch, dura mater and nerve roots were visualized well at the affected levels. Hypertrophic changes of the inferior margin of the pedicle, thickness of the lateral lamina and tightness of the root in the foramen were confirmed step by step. Causes of the stenosis in the fibro-osseous lumbar canal and foramen were hypertrophy of the pedicle, enlargement of the superior and inferior articular facet, osseous changes in the posterior structure around the disc space or hypertrophy of the yellow ligament embracing the dura mater covering the cauda equina and nerve root¹⁵⁾. The hypertrophic yellow ligament was removed as much as possible using a small curette and rongeur. When the space of intraspinal canal was not wide enough to get a decompression because of the thickness of lateral laminae, their inner tables were flattened using a surgical air drill. If the space of nerve root in the intervertebral foramen was judged too tight from an exploration with a large angled nerve hook, a far lateral laminectomy and partial resection of the superior and inferior facets were performed to get relief of radicular symptoms. By these surgical maneuvers, the foramen was liberated easily with a regular curette (Fig. 1).

After sufficient extradural decompression for the cauda equina and nerve root, the embracement of these structures with thin silicone rubber was performed to inhibit exuberant fibrous tissue formation at the operative site and to protect these structures from recompression due to the indentation of these fibrous scar tissues (Fig. 2).

PATIENTS

Thirty six consecutive patients with lumbar or lumbosacral stenosis underwent the procedure described above. All were over 50 years of age, and all were proved to have lumbar or lumbosacral stenosis due to fibro-osseous changes of the spinal canal predominantly. In order of frequency, the most

common symptoms were low back pain, pains in a radicular distribution, and a neurogenic intermittent claudication (Table 1).

On the myelography, the typical findings of the antero-posterior views were segmental "wastlike" narrowing of the contrast column, with distortion and underfilling of adjacent roots. In lateral views, an encroachment of the contrast column by spondylotic spurs, a hypertrophy of the yellow ligaments and disc herniation were seen as a occasional finding. After the myelography, a computerized tomography of the lumbosacral region was performed usually. And the exact information of foraminal involvement was also confirmed. In many cases, the central and lateral indentations of the degenera-

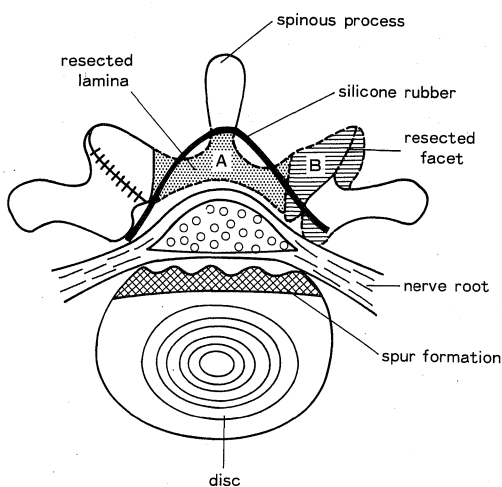
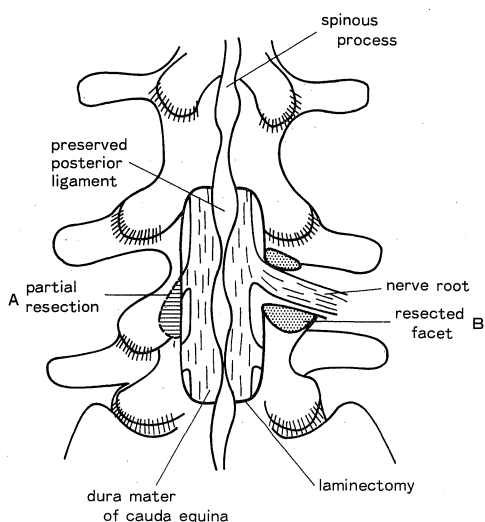


Fig. 1. Preserving the supraspinous ligament with tips of the spinous process of spine, the posterior neural arch of the affected spine is removed by the transection of the pars interarticularis. The hypertrophic yellow ligament is removed as much as possible and the inner table of lateral lamina is also flattened with a surgical air drill. If the nerve root in the foramen is too tight in spite of this maneuver, the partial resection of a causative facet (A) or a foraminotomy (B) is performed to relieve the root signs adequately.

Fig. 2. In order to inhibit the exuberant fibrous tissue formation, the embracement of the dura mater covering the cauda equina and nerve root with a silicone rubber is performed. A: the portion resected usually in the laminectomy, B: the portion resected in the case who requires the decompression of the nerve root.

Table 1. Laminectomies for Lumbar stenosis (36Cases)

	Cases	%
Pain of lower extremities (sciatica)	26	72
Sensory disturbance	18	50
Motor disturbance	14	39
Urinary incontinence	5	15
Intermittent claudication	22	61
Lower back pain	33	92

(1981-1988)

Table 2. Myelographic findings in 36 cases

	Cases	%
Block L ₂₋₃	2	6
Block L ₃₋₄	4	11
Block L ₄₋₅	8	22
Multiple L _{2-L5}	22	61
Total	36	100

tive tissues were coexistent. Recently magnetic resonance imaging is used as the first step of diagnostic procedure. The distribution of levels encountered is summarized in Table 2.

RESULTS

The follow up period ranges from 18 to 84 months (mean 41.5 months). Postoperative evaluation was carried out using the simple grading system for lumbar discotomy divided by Finneson and Cooper⁷⁾. All but 6 patients were relieved of sciatica ; of 22 patients who presented with neurogenic intermittent claudication, 16 (73%) obtained complete relief and 6 (27%) were significantly improved. Walking distances in these patients became much longer in comparison with the state before operation (Table 3).

There were no serious complications. In two patients with small dural tears during operation, the pseudomeningocele was developed because of the difficulty of tissue adhesion owing to the embracement with the silicone rubber. But they were repaired by ventriculo-peritoneal shunt. No patients have had postoperative instability, and no patient has yet required surgery for restenosis of the operative site (Fig. 3).

DISCUSSION

In order to improve postoperative results and to decrease the recurrence of symptoms due to postoperative instability of the spine or restenosis of the lumbosacral canal, many surgical techniques

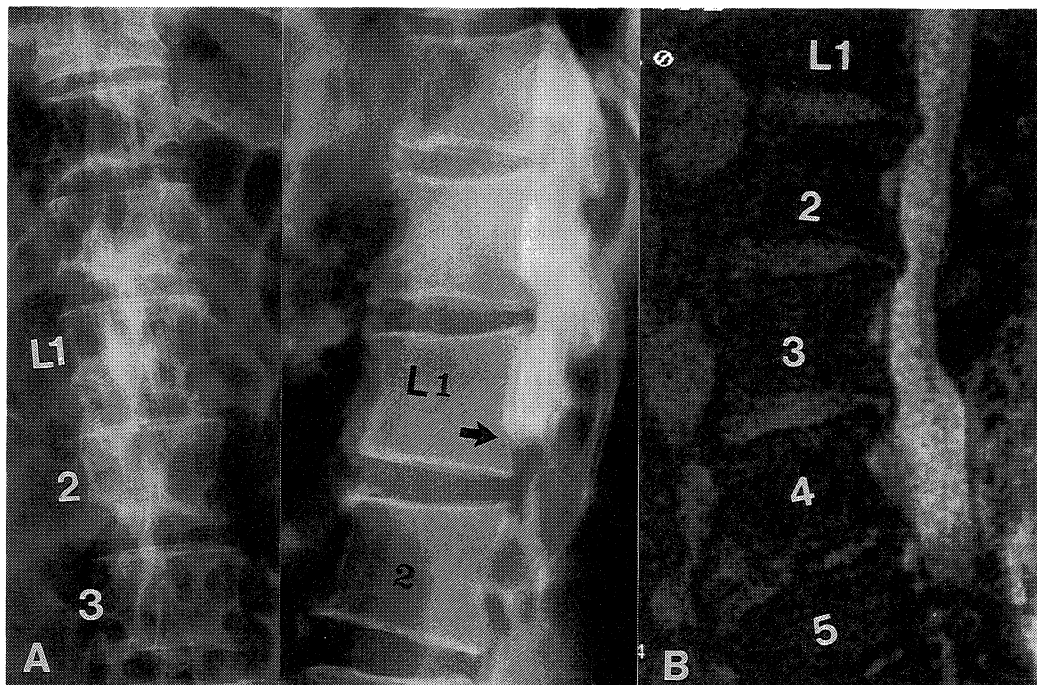


Fig. 3. A myelography of 56 year old woman who had radicular symptoms of both lower extremities, urinary incontinence and a neural intermittent claudication, showed the complete filling defect of the contrast column in the lower levels than the portion of 2nd lumbar spine (A). A decompressive surgery and a embracement of the cauda equina with a silicone rubber was performed. Six years later after the operation, she was examined with a MRI as a follow-up study. The MRI demonstrated no signs of restenosis due to the indentation of the hypertrophic scar formation (B).

Table 3. Postoperative results

	Cases	Persent
good	17	47%
fair	17	47%
marginal	2	6%
poor	0	0%

(Finesson and Cooper⁷⁾ grading)

have been reported¹⁾¹⁰⁾¹²⁾¹⁴⁾¹⁸⁾²¹⁾.

When a spur or ridge on the posterior surface of the vertebral body traps nerve root in its course against an articular facet, and causes intractable symptoms, it is necessary to make a wide laminectomy, including removal of the inferior and superior articular facets¹⁸⁾. But this radical neural arch resection for multiple levels of lumbosacral spinal stenosis may cause a secondary spondylolisthesis with an increased incidence⁹⁾¹¹⁾¹⁹⁾. We believed that the tissue supporting the spine should be preserved as much as possible. The supraspinous ligament has been emphasized by many authors³⁾⁸⁾¹⁰⁾¹⁶⁾ in determining the stability of the posterior segment, and the importance of the preservation of the integrity of the motion segment in treating lumbar disc disease should be well recognized³⁾⁶⁾. Except for cases whose nerve root could not be decompressed without foraminotomy, we preserved the superior and inferior facets as much as possible.

Restenosis of the lumbosacral spinal canal or the intervertebral foramen is mainly secondary to exuberant fibrous formation at the operative site. This is especially true in cases with congenital spinal stenosis¹⁹⁾. In our past experiences, some patients developed a postoperative hypertrophic scarring at one or more levels where the laminectomies were performed, and these secondary hypertrophic scar formation was the cause of the recurrence of symptoms after the laminectomy. This unexpected finding has emphasized the need for protecting the cauda equina or the nerve root from the indentation of postoperative scars into the spinal canal and intervertebral foramen. We believe that the embracement of the dura mater or nerve root with silicone rubber at the operative site, deserves serious consideration.

REFERENCES

- 1) **Aryanpur, J.** and **Ducker, T.** : Multiple lumbar laminectomies for focal spinal stenosis: Case report. *Neurosurgery* **23** : 111-115, 1988.
- 2) **Blau, J.N.** and **Logue, V.** : Intermittent claudication of the cauda equina. *Lancet*. **1** : 1081-1086, 1981.
- 3) **Bradford, D.S.** : Spinal instability : Orthopedic persecutive and prevention. *Clin. Neurosurg.* **27** : 591-610, 1979.
- 4) **Brish, A., Lerner, M.** and **Braham, K.** : Intermittent claudication from compression of cauda equina by a narrowed spinal canal. *J. Neurosurg.* **21** : 207-211, 1964.
- 5) **Ehni, G.** : Significance of small lumbar spinal canal : Cauda equina compression syndrome due to spondylosis. *J. Neurosurg.* **37** : 490-516, 1968.
- 6) **Ehni, G.** : Failed-beck symposium. Presented at the 31st Annual Meeting of the Congress of Neurological Surgeons, Los Angeles, California, October 19-23, 1981.
- 7) **Finesson, B.E.** and **Cooper, V.R.** : A lumbar disc surgery predictive score card : A retrospective evaluation. *Spine* **4** : 141-144, 1979.

- 8) **Holdsworth, F.W.** : Fractures, dislocations and fracture dislocations of the spine. *J. Bone Joint Surg. (Br)* **45B** : 6-20, 1963.
- 9) **Johnsson, K., Willner, S. and Johnsson, K.** : Postoperative instability after decompression for lumbar spinal stenosis. *Spine* **11** : 107-110, 1986.
- 10) **Joson, R.M. and McCormick, K.J.** : Preservation of the supraspionus ligament for spinal stenosis: A technical note. *Neurosurgery* **21** : 420-422, 1987.
- 11) **Lee, C.** : Lumbar spinal instability (olisthesis) after extensive posterior spinal decompression. *Spine* **8** : 429-433, 1983.
- 12) **Lin, P.M.** : Internal decompression for multiple levels of lumbar spinal stenosis: A technical note. *Neurosurgery* **11** : 546-549, 1982.
- 13) **Pyritz, R.E., Sack, G.H. and Udraheli, G.B.** : Thoracolumbosacral laminectomy in achondroplasia : Long term results in 22 patients. *Am. J. Med. Genet.* **28** : 433-444, 1987.
- 14) **Ray, C.D.** : New techniques for decompression of lumbar spinal stenosis. *Neurosurgery* **10** : 587-592, 1982.
- 15) **Robertson, G.H., Liewellyn, H.J. and Taveras, J.M.** : The narrow lumbar spinal canal syndrome. *Radiology* **107** : 89-97, 1973.
- 16) **Rosenberg, M.J.** : Degenerative spondylolisthesis. *J. Bone Joint Surg. (Am).* **57A** : 467-474, 1975.
- 17) **Rosomoff, H.L.** : Neural arch resection. *in Lumbar Spine Surgery* (Canthen, J.C. eds.). Williams & Wilkins, Baltimore, p. 78-84, 1983.
- 18) **Shenkin, H.A. and Hash, C.J.** : A new approach to the surgical treatment of lumbar spondylosis. *J. Neurosurg.* **44** : 148-155, 1976.
- 19) **Shenkin, H.A. and Hash, C.J.** : Spondylolisthesis after multiple bilateral laminectomies and facetectomies for lumbar spondylosis. Follow-up review. *J. Neurosurg.* **50** : 45-57, 1979.
- 20) **Verbiest, H.** : Results of surgical treatment of idiopathic developmental stenosis of the lumbar vertebral canal. *J. Bone Joint Surg. (Br).* **59B** : 181-188, 1987.
- 21) **Young, S., Veerapen, R. and O'Laoire, S.A.** : Relief of lumbar canal stenosis using multilevel subarticular fenestrations as an alternative to wide laminectomy : Preliminary report. *Neurosurgery* **23** : 628-633, 1988.