

# Neural Decompression by Laminectomy with Spinoplasty for Lumbar Spinal Stenosis

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## ABSTRACT

### BACKGROUND

Lumbar spinal stenosis is one of the common morbid conditions of adult population. Surgical intervention is recommended if conservative treatment is not effective. Aim of the surgery is to decompress neural tissues and it may vary from simple unilateral foraminotomy or laminotomy to multilevel bilateral laminectomy. Conventional laminectomy violates posterior stability and foraminotomy limits access to the neural tissues. Different techniques have been developed for adequate decompression with preservation of posterior stabilizing structures.

### METHODS

Degenerative lumbar spinal stenosis in 22 cases was treated by laminectomy with spinous process osteotomy and re-positioning during October 2007 to August 2009. All cases had back pain with radicular pain and intermittent neurogenic claudication. Average age of the cases was 49.5 years and the average duration of symptom was 7 months. Conservative treatment was tried for 4 months. Average follow up period was 2.5 months.

### RESULTS

Post operatively 82% of the cases were satisfied. There was no radicular pain and intermittent claudication in all cases. Persistence of back pain and numbness in lower limbs was common complaints of majority of the cases.

### CONCLUSION

“Laminectomy with spinous process osteotomy and re-positioning” technique easily decompresses lumbar spinal stenosis with preservation of posterior osteo-ligamentous structure.

**KEY WORDS:** *lumbar spinal stenosis, Laminectomy, restorative spinoplasty.*

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## INTRODUCTION

Lumbar spinal stenosis (LSS) is abnormal narrowing of the central canal or the lateral recess or inter-vertebral foramina (root canal), or its combination. It may be local, segmental or generalized. Stenosis can be due to hypertrophy of soft tissues or bone, and the narrowing can involve the bony canal or the dural sac or both.(fig. 1) Etiology can be congenital (e.g. in achondroplasia) or acquired.<sup>1,2,3</sup> Acquired causes can be degenerative facet joints, hypertrophied ligamentum flavum, chronic disc protrusion with fibrosis, spondylolisthesis or thickening of bone due to Paget's disease.<sup>4</sup> Size and shape of the canal can be evaluated by the help of plain X-ray, CT scan or MRI.

LSS is a common cause of disability in middle-aged and elderly patients. Its typical clinical symptoms are chronic low back pain, sciatica pain in the back of the thigh and calve, and intermittent neurogenic claudication.<sup>4,5,6</sup> The natural history of spinal stenosis is unclear.<sup>7</sup>

If the symptoms are less severe these cases can be treated conservatively with spinal posture and back muscle strengthening exercises.<sup>6,7</sup> Epidural injection of steroid has mixed and temporary effect on the symptoms. Patients with serious or progressive pain or neurological dysfunction need surgical decompression with or without concomitant fusion of the spinal segment. Depending on the pathology it can be done at single level or multiple levels. Decompression procedure may vary from simple unilateral foraminotomy or laminotomy to multilevel bilateral laminectomy.<sup>8</sup> Laminectomy has been the established surgical procedure for lumbar canal stenosis.<sup>9</sup> The conventional laminectomy provides easy access to decompression but, may cause secondary instability.<sup>10,11</sup> Foraminotomy or laminotomy preserves the posterior stabilizing

structure but limits access and might increase the risk of neural tissue injury.<sup>8,9,12,13</sup> To address the shortcomings of laminectomy and laminotomy procedures “laminectomy with restorative spinoplasty” procedures have been developed.<sup>14,15,16,17,24</sup> Since 2007 we have treated 22 cases of LSS using this technique. Cases that had indication of fusion were excluded from the study. Outcome of the surgical procedure is reported in average of 2.5 months follow-up.

#### METHODS AND MATERIALS

Twenty two cases of LSS due to degenerative spondylosis with or without intervertebral disc prolapse and grade I spondylolisthesis was included in this study. The average age of the cases was 49.5 years, ranging from 38 to 68 years. 16 cases were male and 6 were females. Low back pain with radicular pain and intermittent neurogenic claudication were the symptoms in all cases. Bilateral symptoms with

unilateral predominance were present in majority of the cases. The average duration of symptom was 7 months. Neurological deficit in the form of motor and sensory deficit was observed in 14 cases. None of the patients had bowel and bladder involvement. Patients with symptomatic LSS were diagnosed by plain X-ray and MRI study. All cases had multiple level stenosis (2 or >2 levels). All patients received conservative treatment for at least 4 months. Out of 22 cases, 10 cases who had acute and severe symptoms received epidural steroid injections without positive result.

The cases were subjected for surgical decompression by laminectomy with restorative spinoplasty (osteotomy of base of spinous process and repositioning). Intervertebral disc was not removed, but sequestered disc was removed in two cases. In two cases there was minor dural tear which sealed

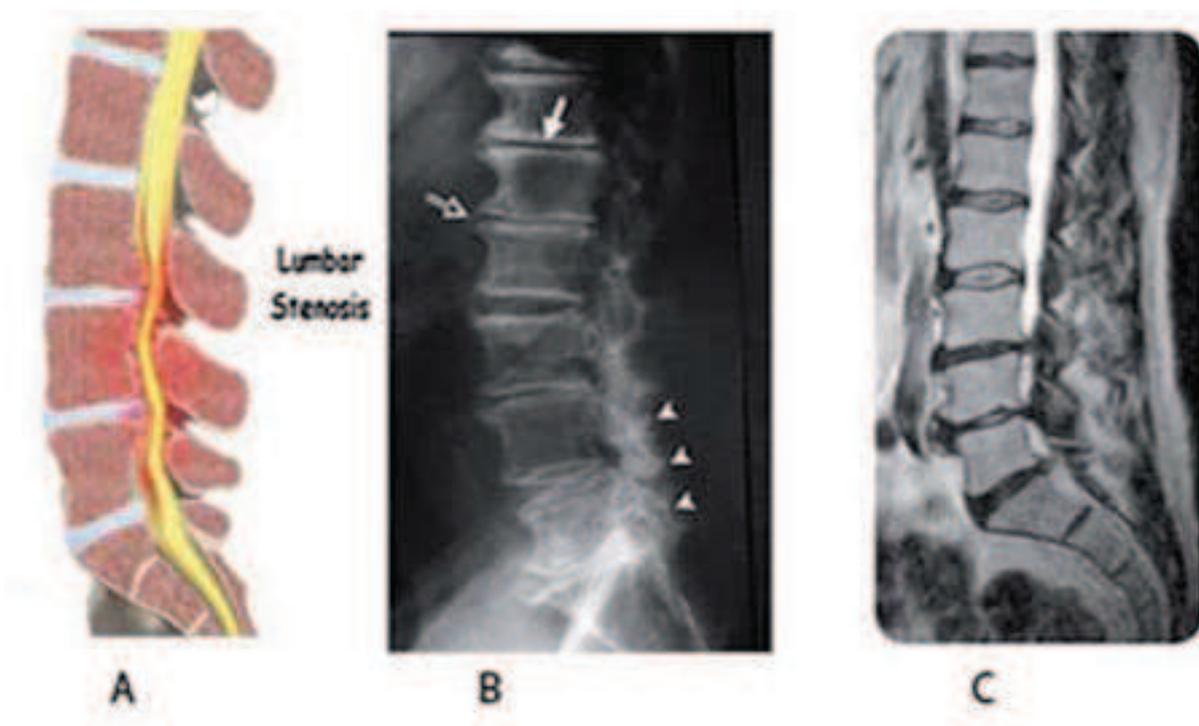


Figure 1. Lumbar spinal stenosis at multiple levels. A. Diagrammatic representation of lumbar stenosis at L3-4 and L4-5. B. Plain X-ray of lumbar spine showing severe degenerative changes at multiple levels. Grade I spondylolisthesis is noted at L4-5 level. C. MRI findings of lumbar spinal stenosis at multiple levels.

itself after applying Abgel. Peri-operative period was uneventful. Symptomatic and neurological improvement was accessed on 5<sup>th</sup> (day of wound inspection) and 14<sup>th</sup> (day of suture removal) post operative day. Patients were asked to come for follow up after 4 weeks of discharge from hospital (first follow-up), after 3 months, after every 6 months. Outcome of surgery was evaluated on every visit.

### Surgical technique

Under general anaesthesia, patients were put on a spinal frame in prone position. Level/s to be decompressed was reconfirmed under image intensifier. A mid line skin incision is given just enough to exposed the targeted level/s. The posterior surface of the vertebral arc (spinous process, lamina and facet joint with intact capsule) is exposed sub-periosteally from one side. With a 20mm curved osteotome, concave surface up, the bases of spinous process of the targeted vertebrae and one vertebra proximal and one distal is osteotomised. With the help of a Cobb elevator opposite side laminae are cleared from soft tissue attachments till the facet joints. The facet joint capsules are kept intact. The whole osteo-ligamentous complex containing spinous processes, supra and interspinous ligaments with paravertebral muscles of opposite side is retracted laterally with self-retaining Gelpi retractors. Center of the posterior

arc of the vertebrae with lamina and facet joints can easily be exposed. Excess of the bone in the bases of osteotomised spinous process is nibbled out with bone nibbler. Thinned out laminae and ligamentum flavum is excised with Kerrison rongeurs to expose the vertebral canal. The lateral recesses and neural foramen can be easily accessed and decompressed from opposite side. (Fig 2) After adequate decompression the laterally retracted osteo-ligamentous complex is repositioned and sutured with ipsilateral thoraco-lumbar fascia after putting a suction drain. Average operating time was about 2 hours.

Post-operatively, patient was allowed to sit up and walk on second or third day with a lumbar corset that was continued for at least 3 months. Isometric back and abdominal muscle exercise were taught and encouraged as tolerated.

### RESULTS

Out come of the surgery was evaluated on the basis of symptomatic relief and neurological improvement. Follow-up of the cases was very poor. Five cases lost in follow up after discharge could not be contacted. Seven patients attended the first follow up (6 weeks post operation) and then were lost. Second follow of up at 3 months were attended by 8 cases and rest of the

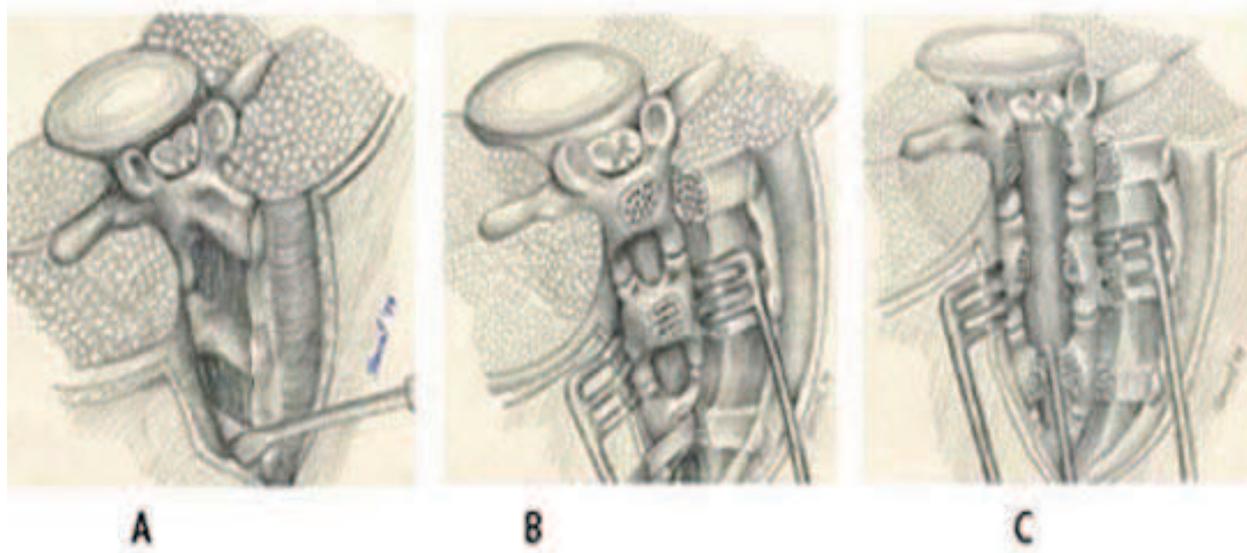


Figure 2: A. Subperiosteal dissection of paravertebral muscles from one side. B. Spinous process osteotomy to expose the laminae and ligamentum flavum. C. neural decompression by Laminectomy.

cases had at least 6 months follow up. Average follow-up was 14 weeks (2 weeks to 84 weeks).

All cases had significant improvement in radicular pain and neurogenic claudication. However, they had persistent back pain. Eighteen patients (82%) were satisfied, 3 were slightly satisfied at their last follow up and one patient was not satisfied. Persistence of back pain and some numbness in lower limbs was the reason for their dissatisfaction.

Radiological evaluation at 3 and 6 months follow up (10 cases) showed healing of osteotomised bases of spinous processes of proximal and distal vertebrae. There was no progression of listhesis and segmental instability.

## DISCUSSION

Degenerative lumbar spinal stenosis (LSS) is a common cause of disability in middle-aged and elderly patients.<sup>5,6</sup> We surgically treated 22 cases of LSS who did not respond to conservative treatment. The decompression procedure was done with spinous process osteotomy and laminectomy as initially recommended by Sano S et al,<sup>15</sup> in his preliminary report in 1983. The aim of this technique is to preserve the posterior stabilizing structures as much as possible. The spinous process is osteotomised from one side so that the opposite side paraspinal muscles are kept intact with its bony and ligamentous attachments. Though the follow up period of the studied cases is short the results are quite encouraging in 2.5 months average follow-up. There was significant improvement in symptoms and neurological impairment in majority of the cases after the decompression. Persistence of back pain and some numbness in the lower limbs was present post-operatively. This is not an uncommon symptom as described by various authors.<sup>22,23</sup>

Many surgical techniques are recommended for decompression of a stenosed lumbar canal. Laminectomy has been a standard procedure<sup>9</sup> but it violates the posterior stabilizing osteo-ligamentous structures.<sup>8,10,11</sup> And thus, might cause secondary segmental instability. Laminotomy or fenestration is a relatively conservative or limited type of surgery that limits access to the neural structures. There is always a problem of incomplete decompression and risk of

neural tissue injury.<sup>8,9,13,19</sup> For adequate access to the neural tissue and preservation of the posterior structures of the vertebrae different techniques; laminectomy with spinous process osteotomy,<sup>14,15,16,24</sup> microendoscopic laminotomies,<sup>18,19,20</sup> spinoplasty<sup>17</sup> method have been recommended. Bresnahan L et al compared the biomechanical changes between conventional laminectomy and posterior element preserving surgeries, and recommended that preservation of the posterior spinal elements could minimize the risk of developing de novo postoperative changes in spinal alignment and/or acceleration of facet and disc degeneration.<sup>21</sup>

Sano S et al introduced the laminectomy with spinous process re-attachment surgical technique in 1983.<sup>15</sup> Watanabe K et al recommended the lumbar spinous process splitting laminectomy for LSS.<sup>16</sup> In recent years also, there are reports on effectiveness of different techniques by Japanese clinicians with good postoperative results. Matsudaira K et al introduced a new technique, modified fenestration with restorative spinoplasty (MFRS) for the treatment of lumbar spinal stenosis. In their series 74% of cases had full satisfaction after surgery.<sup>17</sup> Sasai K had reported good satisfaction with the result of their technique, microsurgical bilateral decompression via a unilateral approach, applied in 48 Japanese patients with LSS at 2 years of follow-up.<sup>18</sup> Pao JL et al did microendoscopic decompressive laminotomy (MEDL) in 53 Taiwanese LSS patients. About 85% of cases were satisfied with the surgery.<sup>20</sup> Yagi M et al developed a novel, median-approach microendoscopic laminectomy for LSS decompression and 90% of cases were satisfied with the treatment.<sup>19</sup>

Same out come was observed by S M Tuli et al in their 610 Indian patients in 10 years duration treated by a new technique of spinoplasty.<sup>24</sup> Our results in terms of patient's satisfaction is comparable to other series, 82% cases are fully satisfied and 17% had partial satisfaction in 2.5 months follow up period. In this technique we osteotomise spinous process of one vertebra above and one below the targeted segments for better exposure. There was good union of these spinous processes in 3 months follow up. More extensive study with measurements of canal diameter, symptomatic scoring system and adequate follow up is recommended in future.

## CONCLUSION

The technique of laminectomy with spinous process osteotomy and re-attachment used in our cases provides adequate access for neural decompression and preserves the posterior stabilizing structures. This technique is relatively time saving and simple.

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