Evaluation of result of lumbar laminoplasty for multilevel lumbar canal stenosis

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Article Info

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Received: 12 July 2018
Accepted: 26 August 2018
Available Online: 1 September 2018

ISSN: 2224-7750 (Online)
2074-2908 (Print)

DOI: 10.3329/bsmmuj.v11i3.37702

Keywords: Lumbar canal stenosis; Laminoplasty; Oswestry Disability Index

Cite this article:
Islam MA, Shrestha M, Batajoo S, Mishra D. Evaluation of result of lumbar laminoplasty for multilevel lumbar canal stenosis. Bangabandhu Sheikh Mujib Med Univ J. 2018; 11: 218-221.

Available at:
www.banglajol.info

A Journal of Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

Abstract

The aim of our study is to evaluate the clinical and functional outcome following lumbar laminoplasty with posterior element reconstruction with miniplate and screws for multilevel lumbar canal stenosis. This study was done on 40 patients (18 males and 22 females) of degenerative multilevel lumber canal stenosis patients underwent open double door lumbar laminoplasty with posterior element reconstruction with miniplate and screws from January 2015 to June 2018. Thirty four patients underwent surgery for 2 level involvement and 6 underwent for 3 level involvement of lumbar canal stenosis. The mean post-operative hospital stay was 5.2 ± 1.1 days. Per-operative complication was dural tear in 2 cases. Pre-operative mean VAS score of back pain and leg pain were 7.0 ± 0.7 and 7.2 ± 1.1 which were significantly reduced to 1.0 ± 0.2 and 1.0 ± 0.8 respectively at final follow-up. All patients were followed-up for minimum 1 year. Pre-operative mean Japanese Orthopedic Association score was 8.6 ± 2.2 which was significantly increased to 14.8 ± 0.4 after 12 months of surgery. Pre-operative mean Oswestry Disability Index was 34.4 ± 3.0 which was significantly reduced to 8.5 ± 2.2 after 12 months of surgery. The outcome of lumbar laminoplasty with posterior element reconstruction with miniplate and screws for multilevel lumbar canal stenosis show good result and can be one of the good option for the treatment for multilevel lumbar canal stenosis.

Introduction

The narrowing of the spinal canal, the lateral nerve root canals, or the neural foramen leads to spinal stenosis which derives from hypertrophy of ligamentum flavum or facet, extruded disc, spondylolisthesis or combined pathology.[1] It may be a part of generalized degenerative process at multiple levels or may be localized. Spinal stenosis increases morbidity and hampers the daily activity and functional outcome of the patient. Degenerative lumbar spinal stenosis is the most common cause of lower back and lower extremity pain and disability in elderly patients and reported to be most frequent cause of lumbar spinal surgery.[2-4] The narrowing of the spinal canal can cause compression of a spinal nerve, nerve root and commonly occurs in the lumbar region of the spine, which bears the weight of the upper body and facilitates a significant amount of movement. Treatment can be non-operative treatment,[5] surgical decompression[6] or together with decompression and stabilization with or without instrumentation.[7]

Surgery is indicated in patients who remain symptomatic despite a course of nonsurgical therapy, progressive intolerable symptoms, rapid neurologic progression or cauda equina syndrome or more rarely, for the neurologically catastrophic initial presentations and who have advanced imaging studies that correspond to existing symptoms. Adequate decompression of the neural elements and maintenance of bony stability are necessary for a good surgical outcome for patients with spinal stenosis. Surgical strategy consists mainly of decompression with additional instrumentation if there is spinal instability and when sagittal balance is at risk. There is range of surgical techniques described for the treatment of lumbar canal stenosis, including laminectomy, laminotomy, laminoplasty and microscopic decompression.[8-12]

Laminectomy has long been the method of choice for thorough lumbar decompression. Arthrodesis with or without instrumentation, is also indicated in some patients. Several studies report that surgical treatment produces better outcomes than nonsurgical treatment.[13] Decompressive laminectomy has been widely used for the treatment of lumbar spinal stenosis. However, iatrogenic instability following laminectomy sometimes occurs in patients with

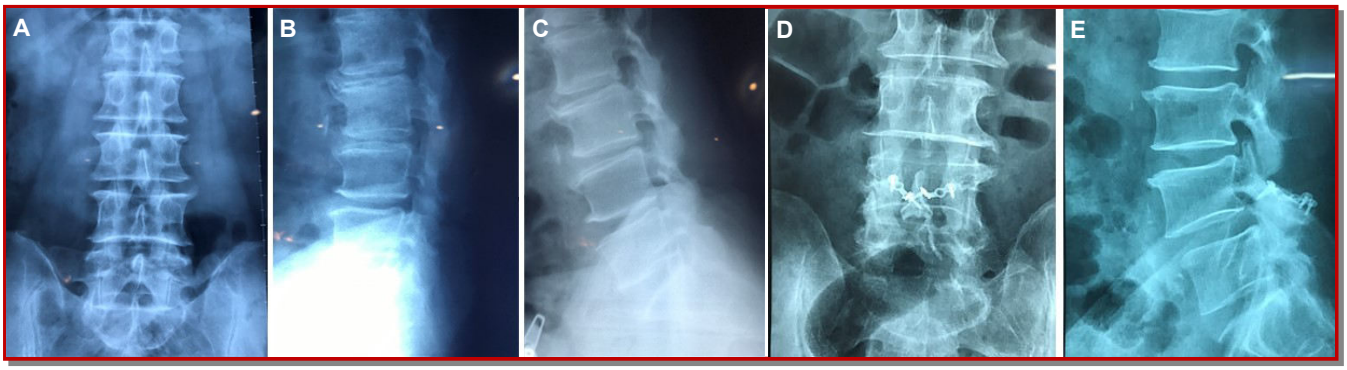

Figure 1: Radiograph showing pre-operative anteroposterior (A), dynamic lateral view (B, C) showing degenerative changes in lumbar spine and no significant spinal instability; Follow-up x-rays showing anteroposterior (D) and lateral (E) views with miniplate and screws *in situ*

degenerative or spondylolisthetic spinal stenosis. Furthermore, the so-called laminectomy membrane, representing epidural scar in the spinal canal, might result in unfavorable sequelae after removal of the laminae. To avoid these problems, the technique of expansive lumbar laminoplasty was developed.[14]

Our study refers to patients with multilevel degenerative spinal stenosis (2 or more spinal segments) excluding any significant spinal instability prior to surgery. The purpose of the present study was to review the clinical and functional outcome of posterior decompression by lumber laminoplasty and posterior element reconstruction using miniplate and screws.

Figure 2: MRI picture showing lumbar canal stenosis at the level of L3-L4 and L4-L5 (A), saggital view (B)

Materials and Methods

Forty cases were included in this prospective study from Bangabandhu Sheikh Mujib Medical University and other private hospital in Dhaka from January 2015 to June 2018. Eighteen cases were males and 22 were female who had more than single level of lumbar canal stenosis with fair trial of conservative treatment. All cases underwent posterior decompression by laminoplasty and posterior element reconstruction using miniplate and screws. Patient with traumatic vertebral body fracture, pre-existing instability of the affected segment, spondylolisthesis, infection and malignancy were excluded from the study. Clinical and functional outcome were evaluated using ODI score for disability,[15] VAS score for pain, and JOA score for severity of backpain.[16] Each case was also evaluated by pre-operative and post-operative X-rays (Figure 1), and pre-operative MRI (Figure 2).

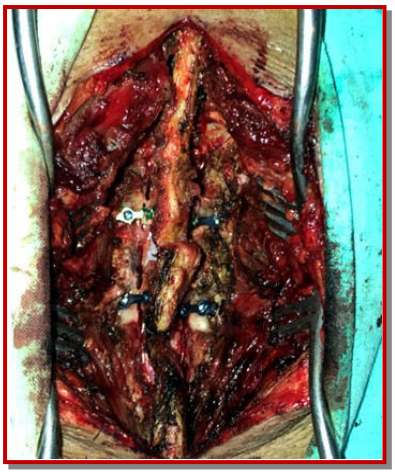

Figure 3: Intra-operative picture showing lumbar laminoplasty with posterior element reconstruction using miniplate and screws

Surgical technique

A vertical posterior midline incision was made over the spinous process up to appropriate level, and the lamina from L1 to S1 depending on the involved levels was exposed. The spinous process, interspinous ligament and infraspinous ligament were preserved carefully. Fenestration and foraminotomy were done by removing the ligament flavum in between two lamina of desired level. Both sides of lamina vertically cut by 2 mm diamond burr then lamina with spinous process separated from pars on both side and it was then pulled 5 mm back then lamina decompressing the affected level and was fixed with the pars by mini titanium reconstruction plate and screw (Figure 3).

Thirty four patients underwent surgery for 2 level involvement and 6 underwent for 3 level involvement of lumbar canal stenosis. No blood transfusion was used for decompression up to 3 levels. The drain was removed after 48–72 hours and the patients were encouraged to walk with a light brace on 3rd or 4th post-operative day. Exercises of the spine taught pre-operatively were encouraged as soon as the post-operative pain subsided. Most of the patients were performing exercises of the spine which they were trained to do before surgery in the recumbent position, such as active spinal extension,

Table I

Mean value of VAS score, ODI score and JOA score in different periods

	Outcome variables (score)		
	VAS	ODI	JOA
Pre-operative	7.0 ± 0.7	34.4 ± 3.0	8.6 ± 2.2
3 months	1.1	8.5	14.6
6 months	1.0	8.5	14.8
Final follow-up	1.0 ± 0.2	8 ± 1.8	14.8 ± 0.4

VAS score for pain, ODI score for disability and JOA score for severity

lifting of lower limb against gravity to strengthen the abdominal wall muscles and muscles of the hip joint. The spinal brace was gradually discarded about 3 months after the operation. No restrictions were imposed on the physical activities of the patients after 3 months of the operation.

Statistical analysis

The collected data were evaluated using paired t-test with significance level of p≤0.001.

Results

The mean age of the study subjects was 56.8 ± 7.5 years. Out of 40 cases, 34 patients underwent surgery for 2 level involvement and 6 underwent for 3 level involvement of lumbar canal stenosis. The mean post-operative hospital stay was 5.2 ± 1.1 days. Per-operative complication was dural tear in 2 cases.

Pre-operative mean VAS score of back pain and leg pain were 7.0 ± 0.7 and 7.2 ± 1.1 which were significantly reduced to 1.0 ± 0.2 and 1.0 ± 0.8 respectively at final follow-up (Table I). All patients were followed-up for minimum 1 year. Pre-operative mean JOA score was 8.6 ± 2.2 which was significantly increased to 14.8 ± 0.4 after 12 months of surgery. Pre-operative mean ODI was 34.4 ± 3.0 which was significantly reduced to 8.5 ± 2.2 after 12 months of surgery.

Discussion

The findings of our study is similar to that reported after laminectomy[17] and appear to be better than those associated with minimally invasive forminotomy.[12, 18] The VAS scores of our study shows significant improvement from 7.0 ± 0.7 pre-operatively to 1.0 ± 0.2 at final follow-up which is statistically significant and is similar to other studies.[19-21] Severity of back pain was reduced markedly in our study which is evaluated with JOA score, which improved from 8.6 ± 2.2 pre-operatively to 14.8 ± 0.4 post-operatively and disability index i.e. ODI score of our study improved to 8 ± 1.8 post-operatively, both of which is also similar to other studies.[19-21]

Only 2-3 level involvement of spinal segments were included in this study considering more levels of spinal involvement would require posterior stabilization and other techniques would be better option. Although other cases of lumbar canal stenosis especially with spinal instability was not included in this study. It significantly states that it is also a good option for multilevel degenerative lumbar canal stenosis. As with this surgical procedure more or less total decompression of neural elements can be done, so that functional outcome is very significant regarding to pain, disability.

Conclusion

The outcome of lumbar laminoplasty with posterior element reconstruction with miniplate and screws for multilevel lumbar canal stenosis shows good result and can be one of the good option for the treatment for multilevel lumbar canal stenosis.

Ethical Issue

Informed consent was taken from the patient. Confidentiality, privacy of the patient, privileged communication and respect and responsibilities were maintained.

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