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Original Article

Comparative Study of Functional Outcome Analysis and Extent of Paraspinal Muscle Damage between Lumbar Spinous Process Splitting Decompression and Conventional Midline Decompression for Lumbar Canal Stenosis

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Abstract

Introduction: It occurs in middle- and old-age people with back pain and lower extremity pain precipitated by walking and standing lumbar canal stenosis causes signs of intermittent neurogenic claudication. Conservative management provides only short-term relief. Surgical option includes midline decompression by laminectomy. This method involves damage to the integrity of posterior complex of spine and elevation of paraspinal muscles from the spinal process which results in paraspinal muscle atrophy, spine extensor weakness, andiatrogenic instability of the spine.

Aim: The aim of this study was to find the functional outcome and the extent of paraspinal muscle damage between lumbar spinous process splitting decompression and conventional midline decompression (CMD) by laminectomy.

Methods: Twenty patients with degenerative lumbar canal stenosis are randomly divided into two groups such as CMD (laminectomy) and lumbar spinous process splitting decompression.

Results: In our study, among the patients who underwent lumbar spinous process splitting decompression, 40% had an excellent recovery rate according to the Japanese Orthopaedic Association score in contrast to 30% who underwent conventional decompression.

Conclusion: Lumbar spinous process splitting decompression provides minimal exposure for decompression in lumbar canal stenosis while preserving musculoligamentous attachments of the posterior elements of the spine and good post-operative results.

Key words: Conventional decompression, Lumbar canal stenosis, Spinous process splitting decompression

INTRODUCTION

Lumbar spinal canal stenosis is a clinical syndrome of back or leg pain with characteristic provocative and palliative features, which occurs due to narrowing of the spinal canal, nerve root canal, and the intervertebral foramen.[1,2] Lumbar spinal canal stenosis has been regarded as "the forgotten spinal disease" for more than 100 years. This neglect occurred because of the association between herniated intervertebral discs and sciatica that received most of the attention after it was discovered by Barr and Mixter in the year 1934.[3] However, lumbar spinal canal stenosis was not widely understood until Verbiest in 1954 described the classic finding of this syndrome.[4] It occurs in middle-aged and older adults with back pain and lower extremity pain precipitated by standing and walking and aggravated by hyperextension. The secondary degenerative changes that further narrow the lumbar spinal canal precipitated

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symptoms. Lumbar spinal canal stenosis now is an accepted clinical entity. The degenerative lumbar spinal canal stenosis is due to thickening of interspinous ligament, ligamentum flavum, and facet joint hypertrophy.[3,5] Lumbar spinal canal stenosis causes signs of intermittent neurogenic claudication, and it can lead to decreased quality of life. Conservative measures provide relief from symptoms for a shorter period only, but finally surgical decompression of the neurovascular structures will be needed.[6] At present, various surgical options are available. The surgical options include midline decompression by laminectomy, different kinds of unilateral and bilateral fenestrations, and partial or full hemilaminectomies.[4,7] Nowadays, it is not very clear which of the techniques is the most favorable and their long-term results are inconclusive. Moreover, the elderly patients have associated comorbid conditions compared to younger generation problems regarding various surgical procedures need to be addressed. Such choices of procedure are important because greater invasiveness associated with higher mortality, greater complications but generally similar clinical benefits use. Hence, the risk versus benefit ratio was carefully weighed before choosing the surgical procedure. Standard conventional laminectomy is the commonly performed surgical treatment for degenerative lumbar canal stenosis.[8,9] This method involves damage to the integrity of posterior complex of spine and elevation of paraspinal muscles from the spinous processes which results in paraspinal muscle atrophy, spine extensor weakness, iatrogenic instability of spine, and possibly, "Failed back syndrome."[9,10] Lumbar spinal stenosis decompression by spinous process splitting laminectomy method was thought to avoid paraspinal muscle damage and extensor weakness by preserving muscle and ligamentous attachments to the spinous processes.[11] We present a prospective randomized control study comparing the outcome of lumbar spinous process splitting decompression and conventional midline decompression (CMD) by laminectomy in 20 patients who underwent surgery for lumbar spinal canal stenosis.

Aim

The aim of the study was to analyze the functional outcome and the extent of paraspinal muscle damage between lumbar spinous process splitting decompression and CMD by laminectomy to preserve the posterior musculoligamentous complex.

MATERIALS AND METHODS

This is a prospective study conducted in the Department of Orthopaedics, Tirunelveli Medical College Hospital. Institutional Ethics Committee approval and informed consent from the patients were obtained. Patients meeting the following inclusion criteria were enrolled for the study; 20 patients with degenerative lumbar canal stenosis are randomly divided into two groups such as CMD (laminectomy) and lumbar spinous process splitting decompression.

Inclusion Criteria

1. Degenerative LCS affecting 3 or less levels,
2. Typical neurogenic claudication symptoms,
3. Magnetic resonance image demonstrating good clinical correlation, and
4. Failure of conservative methods of treatment for a minimum period of 6-month.

Exclusion Criteria

1. Spondylolisthesis with slip Grade 2 or greater (Meyerding grade),
2. Instability at the level of stenosis (as defined by >3 mm translation or >10° angular change on flexion-extension lateral radiographs),
3. Associated symptomatic cervical or thoracic stenosis,
4. Multiple-level canal stenosis,
5. Spinal canal stenosis due to congenital, traumatic, and iatrogenic causes,
6. Presence of spinal disorders (ankylosing spondylitis and neoplasm), and
7. Comorbidities (such as cardiopulmonary insufficiency, peripheral neuropathy, peripheral vascular disease, prior lumbar spine surgery, and severe hip or knee disease).

RESULTS

Twenty patients were followed up for 6-18 months with a mean average follow-up of 11.4 months. Data of 10 patients (5 men and 5 women) in the lumbar spinous process splitting decompression group and 10 patients (4 men and 6 women) in the CMD group were included in the final analysis. The mean age was 58.9 (range: 54-65) years for the lumbar spinous process splitting decompression group and 60.4 (range: 55-65) years for CMD group. The mean number of decompressed levels was 1.30 for CMD group and 1.20 for lumbar spinous process splitting decompression (Table 1). Average ambulation time of Lumbar spinous process splitting decompression was 4.45 days, lesser than CMD group (Table 2).

Japanese Orthopaedic Association Score (JOA Score)

In the lumbar spinous process splitting decompression group, JOA score improved from pre-operative mean 5.4-12.50 at the last follow-up. In the CMD, the score improved from pre-operative mean 5.3-11.3 at the last follow-up. The mean JOA recovery rate was 73.96% for the lumbar spinous process decompression group and 61.86%

Table 1: Pre-operative parameters

Contents	Conventional midline decompression (laminectomy)	Lumbar spinous process splitting decompression
Average age	60.4	58.9
Mean number of decompressed levels	1.3	1.2
Associated protruded disc removal	6	7
Average duration of follow-up	11.6 months	11.2 months

Table 2: Post-operative parameters

Contents	Conventional midline decompression (laminectomy)	Lumbar spinous process splitting decompression
Average ambulation time	6.52 days	4.45 days
Wound complications	1	1
Urinary tract infections	2	-
Lower respiratory tract infection	2	-
Instability	1	-

Table 3: JOA score

Parameter	LSPSD	CMD (laminectomy)
Pre-operative JOA score	5.4	5.3
JOA score at last follow-up	12.5	11.9
Change in JOA score	7.1	6.6
JOA recovery rate (%)	73.96	68.05

JOA: Japanese Orthopaedic Association, LSPSD: Lumbar spinous process splitting decompression, CMD: Conventional midline decompression

Table 4: NCOS

Variables	LSPSD	CMD (laminectomy)	Significance ($P<0.05$)
Pre-operative NCOS score	28.30	27.60	($P>0.05$)
NCOS score at last follow-up	66.10	65.10	($P>0.05$)
Change in NCOS score	37.80	37.50	($P>0.05$)

NCOS: Neurogenic claudication outcome score, LSPSD: Lumbar spinous process splitting decompression, CMD: Conventional midline decompression

Table 5: BPVAS

Parameter	LSPSD	CMD (laminectomy)	Significance ($P<0.05$)
Pre-operative BPVAS	7.8	7.7	($P<0.05$)
BPVAS score at last follow-up	2.7	3.7	($P<0.05$)
Change in BPVAS	5.1	4.0	($P<0.05$)

LSPSD: Lumbar spinous process splitting decompression, CMD: Conventional midline decompression, BPVAS: Visual analog scale for back pain

for the CMD group. There was no statistically significant difference between the two groups.

Notably, 70% of CMD group had good or excellent outcome while 100% of unilateral decompression group had good or excellent outcome (Table 3).

Neurogenic Claudication Outcome Score (NCOS)

NCOS score improved from a mean pre-operative score of 28.30-66.10 at last follow-up in the lumbar spinous process decompression group and from 27.60-65.10 in the CMD group. Statistical analysis did not reveal any significant difference between groups (Table 4).

Visual Analog Scale for Back Pain (BPVAS)

At the last follow-up, the mean BPVAS score for the lumbar spinous process decompression group was 2.7 and for CMD group, it was 3.70. Statistical analysis revealed a significant difference between the two groups (Table 5).

Neurogenic Claudication VAS (NCVAS)

Mean NCVAS score at the last follow-up was 2.10 for lumbar spinous process decompression group and 2.0 for the CMD group. There was no significant difference between the two groups.

DISCUSSION

With 20 patients, we have presented the prospective, randomized control study comparing the short-term functional outcome of lumbar spinous process splitting decompression with CMD by laminectomy. The two groups of our study were comparable to each other in terms of patient characteristics such as age and sex. Degenerative canal stenosis affects more females than males.[2,7] In our study, the complications were few and were comparable between groups. Other complications such as dural tear (one patient 10%) and wound dehiscence (one patient 10%) were observed equal in frequency in both the groups. The average ambulation time in lumbar spinous process splitting decompression (4.45 days) was less when compared to CMD by laminectomy (6.52 days). Post-operative radiological evaluation to assess the instability was not routinely performed and when the clinical symptoms and signs of back pain and claudication persist, X-rays of lateral view, flexion, and extension view were taken to rule out post-operative instability.[8,11] One patient developed instability in the last follow-up in CMD group, later posterior fusion and pedicle screw instrumentation were done. The complications are in the expected frequency. No case of new neurological deficit was observed following surgery in both the groups. Hence, lumbar spinous process

splitting decompression appears to have safety profile comparable with CMD regarding early mobilization and decreases back pain VAS due to preservation of posterior musculoligamentous complex.[6]

CONCLUSION

In our study, lumbar spinous process splitting decompression provides minimal exposure for decompression in lumbar canal stenosis while preserving musculoligamentous attachments of the posterior elements of the spine and good post-operative results after 1 year with favorable outcomes of at least 70% on the JOA score and NCOS. With both these surgical techniques, a significant improvement in the outcome after surgical decompression could be demonstrated. There was no significant difference between the lumbar spinous process splitting decompression and midline decompression by laminectomy techniques regarding the later outcome. However, the minimal invasive procedure seems to be more favorable in elderly patients in the early post-operative period. However, long-term results still need to be evaluated further.

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