ejpmr, 2018,5(10), 306-309

SJIF Impact Factor 4.897

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

A COMPARATIVE STUDY OF FUNCTIONAL OUTCOME OF LAMINECTOMY AND LAMINOTOMY FOR THE SURGICAL MANAGEMENT OF LUMBAR SPINE STENOSIS IN SOUTH INDIAN POPULATION

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Article Received on 13/08/2018 **Article Revised on 03/09/2018** **Article Accepted on 24/09/2018**

ABSTRACT

Background: Laminectomy and bilateral laminotomy as a fenestration method have been used to improve pain, neurogenic claudication and neurological impairment in patients with lumbar stenosis. It is not known whether the two surgical procedures have the same effectiveness in management of lumbar canal stenosis. This clinical descriptive study aims to establish if differences exist in functional outcome, as well as disability, in patients undergoing laminectomy or laminotomy surgery for lumbar spinal stenosis. **Methods:** We conducted a single centre, prospective study of 60 patients undergoing laminectomy or laminotomy surgery for LSS, from June 2016 to 2018. Clinical outcome for back and leg pain were analysed using Oswestry Disability Index (ODI) questionnaires and visual analogue scale (VAS) scores collected preoperatively, at 6 weeks and 6 months. **Results:** 53% were males (n=32) and 43% were females(n=28) with a mean age of 65.3 years and L4/5 being the level most frequently decompressed. Considering all surgeries, a statistically significant reduction in VAS back pain between pre-op and 6 weeks was seen (P<0.001). There was a significant (P<0.0001) average reductions in LBP and leg pain after six months, with minimal difference between laminectomy and laminotomy. ODI scores significantly improved for laminectomy and laminotomy from pre-op to 6 weeks and six months with no statistically significant difference between groups. **Conclusions:** Both surgeries were equally effective in improving leg pain and LBP, and disability for a longer period but the use of bilateral laminotomy in lumbar stenosis can provide good surgical outcome comparable to that in laminectomy in short term follow up like in our study at six weeks .On the basis of functional outcomes and disability both are not superior to each other but for a faster recovery and minimal complication laminotomy can be performed.

KEYWORDS: Laminectomy; laminotomy; Visual Analogue Scale.

INTRODUCTION

Low back pain (LBP) is a common cause of morbidity and disability, with a prevalence of 28.5% in one recent study.[1] There are many causes of chronic LBP, one of which is said to be lumbar spinal stenosis (LSS).[2] Incidence increases with age and hence a large proportion of sufferers are post retirement age with a peak at the age of 73.[3] Symptomatic LSS causes neurogenic claudication, back and radicular leg pain. In severe cases, this can lead to cauda equina syndrome with loss of bladder and bowel control.[4] Spinal decompression surgery has long been considered the gold standard surgical treatment for symptomatic LSS. The aim of surgery is to improve radicular leg pain and walking distance. It is also noted that some have noticed improvement in associated LBP following decompression surgery.[5] Traditionally, open laminectomy has been used effectively in many cases. Of late usage of other surgical techniques like laminotomy is on the rise. Both approaches aim to improve radicular leg pain, subsequently improving functional ability and as noted by a recent study has the potential to significantly improve back pain and quality of life.

The Spine Tango Registry report has identified that general complications were higher for laminectomy when compared to laminotomy. Laminectomy for LSS in comparison to newer and less invasive surgeries, such as laminotomy, is associated with more blood loss, postoperative wound pain, prolonged hospital-stay and paraspinal muscle devascularisation.[6]

Laminectomy for LSS is considered the standard surgical option to which other techniques are compared. To select the better one among decompression techniques we need to know the differences in the complication rates and the functional and symptomatic outcomes. This study aims

to establish if any differences exist in the clinical outcomes of laminectomy versus laminotomy surgery.

METHODOLOGY

Patients who have undergone surgery for lumbar spinal stenosis in over a period of 2 years (June 2016-2018), all patients with confirmed LSS on MR imaging who had failed conservative management, were considered for operative management. Patients with spondylolisthesis, or scoliosis and those who had undergone fusion, discectomies were excluded from the study. Following exclusions, 67 patients were enrolled; among which 7 patients could not be followed up for various reasons, among rest 35 patients underwent a laminectomy without fusion and 25 underwent either a bilateral or unilateral laminotomy. This study was done prospectively. All patients provided informed consent and completed an Oswestry Disability Index (ODI) and visual analogue scale (VAS) pre-operatively and in follow-up clinics at 6 weeks and 6 months. Questionnaire was translated in local language too. The primary outcome investigated back and leg pain for both the laminectomy and laminotomy groups at the given time intervals using visual analogue scale and post-operative disability was analysed using ODI scale. Pre- and post-operative scores in the laminotomy and laminectomy groups were compared using the unpaired two-sample *t*-test and ANOVA, with a P value of <0.05 considered to be significant. SPSS Version 21 was used.

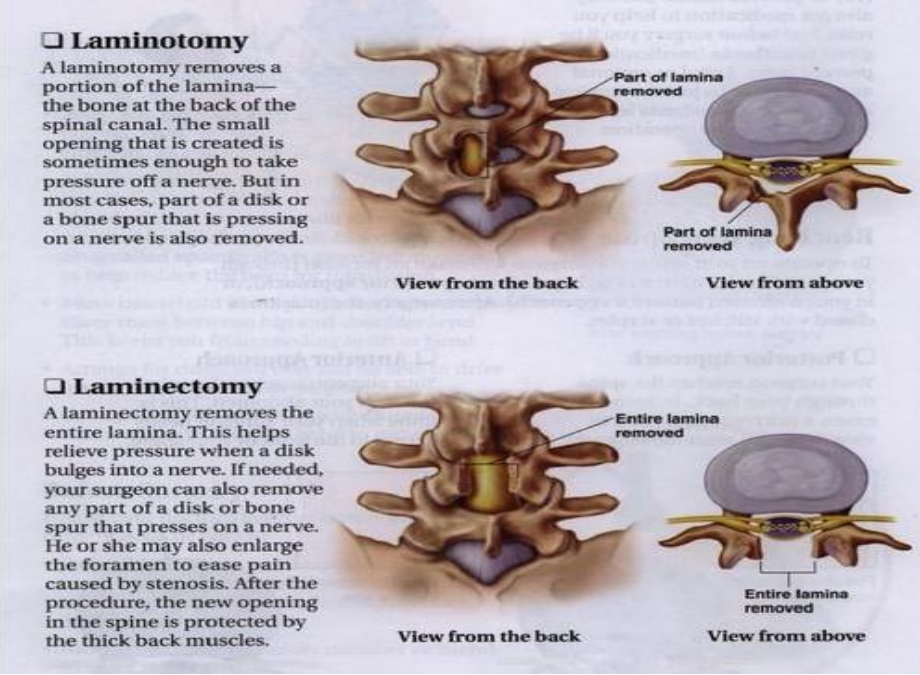
The same surgeon performed all surgeries according to normal protocol. Laminectomy was performed in patients with severe stenosis in the mid zone of foramen and laminotomy performed for predominantly central and foraminal entry zone stenosis.

Bilateral laminotomy

Under general anaesthesia, linear midline posterior skin incision was used, the muscle was split at the midline and continued by sub-periosteal dissection downward until the lamina and facets of the stenotic level were exposed, then the spine retractor was placed. The Kerrison rongeur was used to undercut portion of the lamina at the stenotic levels then angled laterally to undercut the medial facets on each side, to visualize the edge of the dura, and to decompress the nerve roots while leavingmost of the facets intact. The decompression was advanced to the lateral recesses and foraminal areas until all hypertrophic flavum ligament and hypertrophic facet joints, which encroached on the roots, had been completely removed. It involved a wider decompression of the spinal canal while maintaining most of the lamina and bone structures and included confirmation of dural pulsation. The disc spaces were carefully assessed for herniated disc material or prominent bulges, and when necessary, the discs were removed. Homeostasis was confirmed by bone wax and cauterization, vacuum drain was placed then the fascia and skin were closed in layers.[7,8]

Laminectomy

The decompressive procedure consisted of removal of the spinous process, bilateral laminectomy, partial bilateral facetectomy, and foraminotomy. Complete decompression of the Spinalcanal, Lateral recesses and Root canals was done to achieve total decompression of the cord and bilateral nerve roots.



Picture 1: Laminotomy and Laminectomy.

RESULTS

In our study around 60 patients were analysed, 53% were males (n=32) and 47% were females (n=28) with a mean age of 65.3 years. In our study group 35 patients underwent a laminectomy and 25 underwent either a bilateral or unilateral laminotomy. The most frequent level of pathology was L4/5.

We analysed the difference in VAS low back pain and leg pain both between groups and within groups in ours study population. In both groups there was significant reduction in VAS low back pain score from Pre op to 6 weeks and 6 months which was statistically significant (P<0.001). Overall, significant reductions in LBP was sustained even upto 6 months in both methods. (P<0.001). We further compared the difference in the two methods periodically while there was a statistically significant difference in the VAS score at 6 weeks where laminotomy had a better results. But this difference was not seen at 6 months where the decrease in VAS is similar in both groups – that is laminectomy *vs.* Bilateral laminotomy.

Table 1: VAS low back pain score.

	Mean vas low back pain score			
Surgical method	**Pre-OP**	**6 Weeks**	**6 Months**	**P Value**
Laminectomy	6.67	5.32	3.18	< 0.001
Laminotomy	6.82	4.09	3.21	<0.001
P Value	0.192	0.021	0.813	

Similar to above results both laminectomy and laminotomy groups had statistically significant improvements in VAS leg pain score after 6 weeks (P<0.001), also a greater improvement in leg pain at 6 months was seen in both laminectomy *vs.* laminotomy patients. While we analyzed the difference in methods ie. Laminectomy *vs.* bilateral laminotomy there was significant difference in the reduction of leg pain at 6 weeks (P=0.013) whereas no such difference was seen at 6 months between groups.

Table 2: VAS leg pain score.

	Mean Vas Leg Pain Score			
Surgical Method	**PRE-OP**	**6 Weeks**	**6 Months**	**P Value**
Laminectomy	6.87	4.42	3.01	< 0.001
Laminotomy	6.62	3.58	2.98	<0.001
P Value	0.812	0.013	0.631	

Next we analyzed the Oswestry disability Index in both the group of patients. The average pre-operative ODI score for patients in group of laminectomy was 47.18%, reducing to 25.51% at 6 weeks and was 24.31% after 6 months. These reductions in disability are statistically significant with p value of $p < 0.001$ with the final ODI scores indicative of mild disability. Similarly in laminotomy group initial score of 43.15% reducing to 27.91% at 6 weeks and 25.62% at 6 months. These reductions in disability were also statistically significant with p value of $p < 0.001$. When we analyzed the difference between two methods at 6 weeks and six months there was no significant difference in the reduction of ODI scores with p value of 0.215 at 6 weeks and 0.124 at 6 months.

Table 3: Oswestry disability index comparison.

Surgical method	**Mean oswestry disability index**			
	Pre-OP	**6 Weeks**	**6 Months**	**P Value**
Laminectomy	47.18	25.51	24.31	< 0.001
Laminotomy	43.15	27.91	25.62	<0.001

DISCUSSION

Laminectomy decompression even though a highly fruitful method in treatment of lumbar spinal stenosis, it is associated with significant blood loss, postoperative wound pain, prolonged hospital-stay, extensive soft tissue dissection, paraspinal muscles devascularization and the risk of iatrogenic segmental spinal instability requiring instrumented fusion or stabilization.[6] As a result multiple less invasive methods have been followed with aim to preserve the posterior elements of the spine and soft tissue stripping and hence reduce the risk of iatrogenic segmental instability while maintaining favorable outcomes. These methods include techniques like spinous process splitting laminoplasty, laminectomy preserving spinous process, hemilaminectomy, laminotomy, and microsurgical and endoscopic undercutting laminotomies.[13,14]

The Spine Tango Registry which evaluated the outcome following decompression surgery has results which showed that complications were higher for laminectomy when compared to laminotomy. Particularly an increased requirement of fusion or stabilisation following a laminectomy was seen. Furthermore, a significant

increase in surgical and general complications is seen when laminectomy with instrumented fusion was compared with laminotomy.[13,14] Our results demonstrate in both groups ODI scores improved by an average of 15% (pre-operatively six months) with minimal differences, suggesting each operation had a similar effect upon disability.

Varying degrees of low back pain and leg pain are seen in LSS patients being considered for decompression surgery. At present minimal evidence is there to find superiority of one surgical approach over another. In our study there was a reduction in LBP and leg pain with both surgical methods which is similar to findings in a study done by Jones etal.[15] Although differences in scores were noted between the surgeries after 6 weeks and six months the results had statistically significant difference only at six weeks and not at six months particularly in laminotomy group which shows the recovery is quicker in laminotomy compared to laminectomy. Laminotomy, due to its minimal dissection has a lower complication rate than laminectomy. This study was also done in such a way to analyse the disability which has also similar results to that of VAS score.

In our study, patients with pre-operative higher ODI score, showed similar improvement at 6 months and in both the laminectomy and laminotomy groups and there was not much difference between them. However, at 6 weeks the score was much better in laminotomy patients. There were several limitations of this study including; patient selection bias as a result of a single hospital and surgeon cohort, a relatively small number of patients and a short term follow up.

CONCLUSIONS

This descriptive study demonstrated that the functional outcome of laminectomy and laminotomy procedures were comparable. Both surgeries were equally effective in improving leg and LBP, and disability for a longer period but the use of bilateral laminotomy in lumbar stenosis can provide good surgical outcome comparable to that in laminectomy technique, in short term follow up like in our study at six weeks. Also laminectomy is known to have higher general complication rates compared to alternative decompression methods. On the basis of functional outcome and disability both are not superior to each other but -for a faster recovery and minimal complication laminotomy can be performed.

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