Laminotomy Versus Laminectomy in Surgical Treatment of Multilevel Lumbar Spinal Stenosis in Patients More Than 65 Years Old

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Abstract

Background: In some patients with refractory lumbar spinal stenosis (LSS) surgical decompression is necessary. However, a fear of iatrogenic instability has always been associated with extensive decompression. In this study, we aim to evaluate the surgical outcomes of laminotomy versus laminectomy in the geriatric patients with multilevel LSS.

Methods: We retrospectively evaluated 79 (29 male and 50 female) geriatric patients with multilevel degenerative but stable LSS from August 2008 to September 2011. The mean age and follow-up period was 74 ± 12.1 (ranged: 65 to 83 years old) and 34 ± 6.5 (ranged: 25 to 51 months), respectively. We placed our patients into two groups; A: laminotomy (44 cases) and B: laminectomy (35 patients). Preoperatively and at the last follow-up visit, the patients were assessed by visual analogue scale (VAS) and Oswestry disability index (ODI). Satisfaction rate was also recorded. Then, an intra- and postoperative comparison between these two techniques was carried out, statistically.

Results: No significant differences existed between the two groups in terms of sex distribution, age and duration of follow-up. Intergroup comparison showed that patient satisfaction rate and the mean improvement in VAS and ODI was comparable. Mean blood loss and operating time were both greater in laminotomy group but only the latter was statistically significant.

Conclusions: In geriatric patients more than 65 years old with multilevel but stable degenerative LSS, due to its more simplicity and less operative time, we still prefer and recommend laminectomy versus laminotomy.

Keywords: laminectomy, laminotomy, lumbar spinal stenosis


1. Introduction

Although the main modality for treatment of the patients with lumbar spinal stenosis (LSS) is conservative, surgical decompression is sometime indicated in refractory cases. [1,2] For years, extensive resection of posterior spinal elements including bilateral laminae, supra- and interspinous ligaments, spinous processes, parts of facet joints, pars interarticularis, and ligamentum flavum was the gold standard method for decompression of the stenotic lumbar spine. [3,4,5,6] However, a fear of iatrogenic instability has always been associated with this extensive approach. [7-13] As it has been proven that the main location for LSS is interlaminar windows, many authors have proposed numerous (endoscopic or open) less aggressive surgical techniques to decompress the neural elements while preserving the integrity of important posterior elements. [14,15,16] Decompressive procedures for lateral recess or foraminal stenosis through this limited interlaminar space require more experience and delicate equipment, otherwise the risk of operative complications will rise, significantly. [17]

Since endoscopic spinal decompression is not suitable and feasible in multilevel LSS, in the setting of multilevel LSS, which of the two open decompressive techniques (laminectomy or laminotomy) should be preferred in the patients over 65 years old? In this age group, it’s obvious that the preferred method should have optimal effectiveness and be also associated with less operating time and bleeding. Decreasing the operating time would be probably effective in decreasing the operative complications and morbidities including deep vein thrombosis, pulmonary embolism, rehabilitation time, narcotic dependency, surgical site infection, etc. [18,19] In this study, we aim to evaluate the surgical outcomes of laminotomy versus laminectomy in the geriatric patients with multilevel LSS.

2. Materials and Methods
After local institutional review board approval (code number 921499), we retrospectively evaluated 86 patients with multilevel LSS admitted to our university hospital from August 2008 to September 2011. Inclusion criteria comprised two or more levels of degenerative LSS, significant disability with subjective limitation in maximum standing time or walking distance, those patients with pain persisted even in resting posture that is refractory to aggressive and sufficient conservative treatment (more than three months), and age over than 65 years old. We excluded those cases who received mixed pattern of decompression (like one level laminotomy and one level laminecctomy), and those patients with underlying spinal instability, trauma, or tumor that needed some type of fusion or instrumentation. We included only those patients who underwent simple laminotomy or laminectomy to decompress multilevel of stenosis and those followed-up for more than two years.

Patients were classified into either one of two groups; Group A comprised the patients treated with laminotomy, and Group B consisted of laminecctomy patients (Figure 1). Preoperatively and at the last follow-up visit, we used two types of questionnaires to assess the pain and disability in the patients. Based on Visual Analogue Scale (VAS), we asked the patients to rate their pain intensity on a scale of 0 to 10. [20] This question was asked about the severity of pain in leg and lumbar area, separately. The severity of disabilities was also evaluated by Oswestry Disability Index (ODI), version 2.1. [21] This questionnaire was translated and validated in Persian language patients, previously. [22] At the last follow-up visit, based on Henderson’s functional capacity, we also questioned the patients to rate their subjective satisfaction with the surgery as excellent, good, fair, or poor. [23] We have also taken into account the time to operation (delay for surgical decompression from onset of severe complains) and Body Mass Index (BMI). The latter was calculated as weight (in kilograms) divided by height squared (in meters).

As we had routinely documented the estimated operative blood loss and operative time (from skin incision to skin closure) in the patients’ medical records, a comparison between these two indices was also carried out.

2.1. Surgical Technique

After prone positioning of the patient, abdomen placed free of any external pressure. In Group A, while preserving the interspinous and supraspinous ligaments, the ligamentum flavum at two adjacent levels were excised. In Group B, bilateral laminae associated with spinous process and their attached ligaments were removed completely. In appropriately indicated cases of both groups, partial medial facetectomy and foraminotomy were also carried out to decompress the lateral recess and foraminal stenosis, respectively. Disc sequestrum, free fragments, or severely extruded discs were certainly excised, but especially in laminecctomy patients, as the vertebral canal became uncovered, simultaneous discectomy to achieve more decompression seemed to be unjustified and therefore, it had been preferred as far as possible, not to remove the disc simultaneously to avoid iatrogenic postoperative instability.

2.2. Postoperative Protocol

The patient ambulated a day or two after surgery. As soon as the patient was able to walk and void comfortably, he/she was discharged from the hospital. We usually prescribed a soft lumbosacral corset for about three to four weeks and we recommended the patient not to be placed in a recombinant sitting posture for a long time in one or two months after the operation, especially in discectomy cases.

2.3. Statistics

We used statistical package for the social sciences (SPSS Inc., Chicago, IL, USA) version 11.5 for windows. Spearman correlation coefficient, Chi-square, independent T, Wilcoxon, and Mann-Whitney tests were used in appropriate situations. P value <0.05 was considered significant.

3. Results

We failed to follow-up four cases for a minimum period of two years. Three cases also died during this time. We could finally follow-up 79 cases with 245 levels of stenosis who have been treated by laminotomy or laminecctomy for a mean follow-up period of 34 ± 6.5 (ranged; 25 to 51 months). Discectomy as a part of the operative intervention was performed in 21 from 44 cases (47.7%) with laminotomy, and 12 from 35 cases (34.3%) with laminecctomy. The mean age of the patients was 74±12.1 (ranged; 65 to 83 years old). Demographic data and prevalence of number of stenotic levels in two surgical groups were shown in Table 1. Chi-square and independent T- test results showed no significant differences existed between the two groups in terms of sex distribution, age and duration of follow-up. We had no patient with cauda equina syndrome in this age range.

Wilcoxon test results showed that surgical decompression with either technique could significantly improve pain and disability in the corresponding group (Table 2). Intergroup comparison by Mann-Whitney test showed that the mean improvement in VAS and ODI was relatively similar (Table 3). In this age range, patient satisfaction rate with either of the two techniques was also comparable. A comparison of estimated operative blood loss and operative time was also depicted in this table.

Figure 1. A 76 years old female with two adjacent levels LSS (L3-4 & L4-5) pertaining to Group A. She underwent two levels laminotomy with preserving inter- and supraspinous ligaments. Extruded L3-4 disc was also removed partially.
The mean delay time to operation and BMI in our patients was 6.2 ± 5.1 (ranged; 1 to 49 month) and 27.3 ± 5.4 (ranged; 17.3 to 44.4), respectively. Spearman correlation coefficient indicated that there were no significant relationships between decreasing pain, improving disability, or satisfaction rate with patient delay (time to operation) or BMI (Table 4). We had two cases with iatrogenic partial nerve root injury, both concerning posterior tendon. The latter had no significant complain. Dural tear occurred in five cases (three in Group A and two in Group B). We had only one patient (2.9%) with asymptomatic postoperative instability related to Group B. No other remarkable complication was happened in our patients.

### 4. Discussion

This retrospective study showed that either laminotomy or laminectomy in patients over than 65 years old affected by multilevel LSS could significantly improve pain and disability with comparable satisfactory outcomes. Both operative blood loss and time were greater in laminotomy group, but only the latter was statistically significant. Other indices in our two groups were relatively similar and comparable.

In 2007, Kaptan et al reported their surgical results on 32 patients over 65 years old with LSS who has been treated by laminectomy and foraminotomy. [24] 68.8% of the patients underwent laminectomy, while discectomy due to the presence of an associated lumbar disc herniation was performed in 31.3%. They concluded that in the old patients due to more severe underlying stenosis, total laminectomy was more probably to be carried out to L5. One of them, presented with symptomatic drop foot and later he was treated by anterior transfer of tibialis posterior tendon. The latter had no significant complain. Dural tear occurred in five cases (three in Group A and two in Group B). We had only one patient (2.9%) with asymptomatic postoperative instability related to Group B. No other remarkable complication was happened in our patients.
were treated by open techniques, the operating time in laminectomy group was much lower than laminotomy patients.

In a relatively similar but prospective study, clinical and radiologic results of laminectomy were compared with laminotomy (undercutting decompression). [26] Delank and co-authors in this study placed their patients into two groups; group I comprised laminectomy patients (13 cases) and group II, laminotomy 27 patients. The mean follow-up period was about one year. Again, they did not specify the age and number of stenotic levels in their patients. Like us, they found comparable clinical outcomes in both groups and recommended laminectomy in presence of any doubt of remaining neural compression associated with laminotomy technique without fear of iatrogenic clinical instability. Yu and Tay in another study also compared these two surgical procedures and finally reported good clinical outcome within the first two years of operation, irrelevant to the type of surgery. [27]

In a biomechanical study on 12 cadavers with spondylotic spine, Krämer et al measured the lumbar intrathecal volume before decompression, after laminotomy, and after complete laminectomy. [28] They showed that in intact spondylotic lumbar spine, there was a volume loss in extension relative to flexion posture. After laminotomy, this volume loss significantly decreased and laminectomy could not reduce it further. They concluded that in degenerative LSS, laminotomy is as effective as laminectomy. Our in vivo research also confirmed this issue and due to less operating time in latter, we prefer laminectomy in multilevel stenosis of old patients. In another cadaveric study, Lee et al. studied intervertebral motion characteristics of the lumbar spine after laminectomy versus laminotomy. [29] They measured kinematics of six fresh frozen human cadaveric L1-L5 spine before dissection, after laminotomy and then after laminectomy. They demonstrated that both techniques induced hypermobility, but destabilizing effect of laminectomy in compared with laminotomy was double. They proposed that more preservation of posterior osteoligamentous complex with providing a stabilizing effect may prevent iatrogenic postoperative spondylolisthesis. In the study we conducted, kinematics was not measured but postoperative instability occurred only in one patient belonged to Group B (2.9%).

In a prospective study on 120 patients with 207 levels of LSS, Thomé and his colleges randomized their patients into three groups; Group 1 (bilateral laminotomy), Group 2 (unilateral laminotomy), and Group 3 (laminectomy). [30] Then, they assessed the perioperative parameters and complications for about one year after surgery. They found that both unilateral and bilateral laminotomy gave efficient decompression and good clinical outcomes, comparable with laminectomy. This study didn’t specify the age but the results are similar to ours.

Our study had some important limitations. It was a retrospective study of the operated cases; therefore we could not randomize them. Perhaps, those patients with more severe lumbar spondylisis due to relatively more inherent stability preferably had been treated by laminectomy method and we could not delete this selection bias. Another disadvantage of this study is its apparent relatively old procedures, but we must remember that in multilevel and especially bilateral LSS, many authors do not believe the efficacy, safety, and suitability of endoscopic procedures and on the other hand, in many spine departments throughout the word, minimally invasive equipment are not routinely present. [17] In conclusion, in geriatric patients with multilevel but stable degenerative LSS, due to its more simplicity and less operative time, we still prefer and recommend laminectomy versus laminotomy.

Conflict of Interest

The authors declare no conflicts of interest.

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References


