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## RESEARCH ARTICLE

### COMPARISON OF SURGICAL OUTCOMES IN LAMINECTOMY VERSUS LAMINOTOMY FOR THE MANAGEMENT OF LUMBAR SPINAL STENOSIS

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#### ABSTRACT

**Introduction:** Incidence of Lumbar Spinal Stenosis is increasing exponentially due to changing societal structure. There has been a great advancement in the minimally invasive spinal surgery in the recent years. Minimally decompressive procedures have been proposed for the treatment of spinal stenosis. The objective of the study was to compare the surgical outcome of laminectomy versus Laminotomy for the surgical management of Lumbar Spinal Stenosis. **Methods:** This cross sectional study was conducted at the Department of Neurosurgery Bolan Medical Complex Hospital Quetta and Sandeman Provincial Hospital Quetta, Pakistan from February, 2017 to August, 2018. Patients with >40 years of age of either gender presented with Oswestry disability percentage score of more than 40 pre-operatively and diagnosed as lumbar spinal stenosis with duration of symptoms more than 6 weeks were included. Group A (Laminotomy) patients underwent minimally invasive decompressive procedure. In group B patients, traditional laminectomy was performed. Both groups (A and B) were reassessed after treatment at 12 week follow up by Oswestry disability index (ODI). Outcome of surgery was labelled as good, fair and poor. **Results:** Mean age of the patients was 58.16 ±7.97 years. Mean duration of disease was 7.85 ±0.99 weeks. Male preponderance was found to be higher 117 (68.80%) as compared to females 53 (31.20%). Good outcome was found to be higher 76 (89.4%) in patients with Laminotomy as compared to the patients with laminectomy 53 (62.4%) (p-value 0.001). **Conclusion:** Surgical outcome of Laminotomy was found to be better than laminectomy in surgical management of lumbar spinal stenosis.

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## INTRODUCTION

Lumbar spinal stenosis could be managed by both surgical and non-surgical treatment but most patients are managed surgically (Atlas, 2005; Thome, 2005; Chad, 2007; Truumees, 2005; Robert, 2005 and Chang, 2005). The desire of older patients for mobility and functionality coupled with improved perioperative management has resulted in situation where surgical intervention is being increasingly preferred. There has been a great advancement in the Minimally Invasive Spinal Surgery in the recent years. Minimally decompressive procedures have been proposed for treatment of spinal stenosis (Thomé, 2005).

In our country, data is scarce about the efficacy of decompressive procedures. This study has been designed to compare the surgical outcome of two techniques in our cohort of patients.

## MATERIAL AND METHODS

After the approval of the study by institutional Ethical Review Committee, all patients admitted in Department of Neurosurgery Bolan Medical Complex Hospital Quetta and Sandeman Provincial Hospital Quetta, Pakistan with Lumbar Spinal Stenosis diagnosed clinically and on MRI imaging were considered for enrolment in the study. Clinical symptoms of patients were assessed by Oswestry Disability Index (ODI) for

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back pain, leg pain and walking tolerance in terms of distance, and duration and preoperative percentage score was estimated. Patients of either gender; aged more than 40 years with Oswestry disability percentage score more than 40 pre operatively having symptoms for more than 6 weeks were included in the study. Patients with previous history of spinal surgery, herniated lumbar disc, spinal tumor or cauda equine syndrome were excluded from the study. Patients were randomly divided into two groups, A and B by lottery method. Group A patients underwent minimally invasive decompressive procedure named Laminotomy that includes complete removal of ligamentum flavum, partial excision of laminae, base of spinal process, and small amount of facet process bilaterally. The spinous process, interspinous ligament, facet capsule and part of laminae were meticulously preserved. In group B patients, traditional laminectomy was performed removing lamina, ligamentum flavum, spinous processes with supra and interspinous ligaments. Facet joint capsule was preserved. Surgeries were performed by Consultant Neurosurgeons having at least 5 years of experience. Both groups were reassessed after treatment at 12-week follow-up by Oswestry disability index (ODI). Outcome of surgery was labelled as good (decrease in Oswestry disability questionnaire percentage score of more than 20%), fair (decrease in Oswestry disability questionnaire percentage score of 11% - 20%) and poor (decrease in Oswestry disability questionnaire percentage score of 10% or less).

## RESULTS

Mean age of the patients was  $58.16 \pm 7.97$  years. The minimum age of the patients was 46 years and maximum age of the patients was 67 years. There were 56 (32.90%) patients with  $\leq 60$  years of age and 114 (67.10%) patients with  $>60$  years of age. Mean duration of disease was  $7.85 \pm 0.99$  weeks. The minimum duration of disease was 7 weeks and maximum duration of disease was 9 weeks. There were 97 (57.10%) patients with  $\leq 8$  weeks of duration of disease and 73 (42.90%) patients with  $>8$  weeks duration of disease. Male preponderance was observed with 117 (68.80%) as compared to 53 (31.20%) females. Overall outcome was found to be good in 129 (75.90%), fair 34 (20%) patients and poor 7 (4.10%) patients. Good outcome was found to be higher 76 (89.4%) in patients with laminotomy as compared to the patients with laminectomy 53 (62.4%). Comparison of outcome between groups showed significant difference ( $p$ -value  $< 0.001$ ) (Table 1). Stratification was done to see the effect of age and duration of disease on the outcome. Chi-square test was applied. Results are shown in Tables 2-5. Table no 1 show the outcomes between both groups in general. According to the table results are better for Laminotomy in terms of Good outcome while it has less poor outcomes as compared to the conventional method of Laminectomy.

**Table 1. Comparison of Outcome between Groups**

| Group       | Outcome     |            |          | Total      | P-value |
|-------------|-------------|------------|----------|------------|---------|
|             | Good        | Fair       | Poor     |            |         |
| Laminectomy | 53 (62.4%)  | 27 (31.8%) | 5 (5.9%) | 85 (100%)  | 0.001   |
| Laminotomy  | 76 (89.4%)  | 7 (8.2%)   | 2 (2.4%) | 85 (100%)  |         |
| Total       | 129 (75.9%) | 34 (20%)   | 7 (4.1%) | 170 (100%) |         |

**Table 2. Comparison of Outcome between two Groups with age  $< 60$  year (n=56)**

| Group       | Outcome    |           |           | Total     | P-value |
|-------------|------------|-----------|-----------|-----------|---------|
|             | Good       | Fair      | Poor      |           |         |
| Laminectomy | 21 (63.6%) | 7 (21.2%) | 5 (15.2%) | 33 (100%) | 0.005   |
| Laminotomy  | 23 (100%)  | 0 (0)     | 0 (0)     | 23 (100%) |         |
| Total       | 44 (78.6%) | 7 (12.5%) | 5 (8.9%)  | 56 (100%) |         |

**Table 3. Comparison of Outcome between Groups with age  $> 60$  years (n=114)**

| Group       | Outcome    |            |          | Total      | P-value |
|-------------|------------|------------|----------|------------|---------|
|             | Good       | Fair       | Poor     |            |         |
| Laminectomy | 32 (61.5%) | 20 (38.5%) | 0 (0)    | 52 (100%)  | 0.002   |
| Laminotomy  | 53 (85.5%) | 7 (11.3%)  | 2 (3.2%) | 62 (100%)  |         |
| Total       | 85 (74.6%) | 27 (23.7%) | 2 (1.8%) | 114 (100%) |         |

**Table 4. Comparison of Outcome between Groups with Duration of Disease  $\leq 8$  Weeks (n=97)**

| Group       | Outcome    |            |          | Total     | P-value |
|-------------|------------|------------|----------|-----------|---------|
|             | Good       | Fair       | Poor     |           |         |
| Laminectomy | 34 (63%)   | 15 (27.8%) | 5 (9.3%) | 54 (100%) | 0.015   |
| Laminotomy  | 38 (88.4%) | 3 (7%)     | 2 (4.7%) | 43 (100%) |         |
| Total       | 72 (74.2%) | 18 (18.6%) | 7 (7.2%) | 97 (100%) |         |

**Table 5. Comparison of Outcome between Groups with Duration of Disease  $> 8$  Weeks (n=56)**

| Group       | Outcome    |            |       | Total     | P-value |
|-------------|------------|------------|-------|-----------|---------|
|             | Good       | Fair       | Poor  |           |         |
| Laminectomy | 19 (61.3%) | 12 (38.7%) | 0 (0) | 31 (100%) | 0.003   |
| Laminotomy  | 38 (90.5%) | 4 (9.5%)   | 0 (0) | 42 (100%) |         |
| Total       | 57 (78.1%) | 16 (21.9%) | 0 (0) | 73 (100%) |         |

Moreover, the P-Value is also significant here. Table no 2 is formulated to focus on the outcomes between Laminectomy and Laminotomy in the age group of <60 years, which shows that Laminotomy shows promising results in this age group as the good outcomes are more than Laminectomy. Additionally, it has less poor results when compared to laminectomy whereas, the results are statically significant. Table no 3 is for the age of > 60 Years. In this age group, Laminotomy shows better results as compared to Laminectomy. However, the poor outcomes in Laminotomy are more than Laminectomy, but the results are statistically significant. Table no 4 shows the comparison in two groups when the duration of disease is < 8 weeks. Here in this table, Laminotomy yields better results as compared to Laminectomy owing to more good outcomes and less poor outcomes. The results here are also statistically significant. According to Table no 5, Laminotomy has better results than Laminectomy when the duration of disease is > 8 weeks. It can be concluded owing to its better outcomes and less poor outcomes. The results are statistically significant here.

## DISCUSSION

Narrowing of spinal canal is termed as Lumbar Spinal Stenosis with resultant compression of neural elements. Lumbar Spinal Stenosis may be classified into two subgroups, congenital/developmental and acquired (Robert, 2005). Acquired Spinal Stenosis is the most common condition leading to spinal surgery in elderly population (Fu, 2008). Spinal canal degenerative changes lead to central stenosis from ligamentum flavum hypertrophy, facet hypertrophy, disc bulging and hypertonic osteophytes while intervertebral foramen compression can result from facet joint hypertrophy (Truumees, 2005). Patients usually present with backache, radiculopathy and neurogenic claudication (Chad, 2007).

The aim of all operative interventions is to decompress neural elements. The incidence of Lumbar Spinal Stenosis is increasing exponentially in patients older than 60 years due to changing societal structure and is found on magnetic resonance imaging in more than 20% of cases (Thome, 2008). The desire of older patients for mobility and functionality coupled with improved perioperative management has resulted in situation where surgical intervention is being increasingly preferred. Lumbar Spinal Stenosis has therefore been gaining importance generally and for Spinal Surgeons in particular (Thome, 2008). Laminectomy is the most popular surgical decompression of Lumbar Spinal Stenosis involving extensive removal of posterior elements including laminae, spinous processes, interspinous ligaments and even facet joints (Rahman, 2009). Decompressive laminectomy is considered the standard surgical treatment in these patients and we routinely perform laminectomy at our Institution. Spinal instability has been implicated as a cause of surgical failures, because wide posterior decompression significantly alters spinal anatomy and biomechanics, thus prompting many spine surgeons to perform fusion procedures to treat Lumbar Spinal Stenosis. Decompressive laminectomy is considered the standard surgical treatment in these patients but according to the results of a Meta-Analysis, it was successful in only 64% of the cases (Postacchini, 1999). Instead of combining fusion with decompression and thus maximizing surgery and associated perioperative risks, other investigators have attempted to decrease the operative failure rate by minimizing the invasiveness of decompressive procedure. Fenestration or

Laminotomy has been propagated to spare the dorsal midline structures completely to maintain normal sagittal spinal alignment in contrast to laminectomy that does not save these important stabilizing structures. Among Various decompressive techniques, encouraging results have been reported particularly for laminotomy in which contralateral decompression is achieved by undercutting the spinous process and widening the contralateral foramen at the same time. Laminotomy is decompressive technique that was used for lumbar discectomy. This minimally destructive procedure has the advantage of preserving most posterior elements with minimal instability post operatively which is, post-laminectomy kyphosis. The window technique removes partial facet joint for enlarging foraminas, ventral cortex and cancellous bone of vestigial laminae and base of spinous process for enlarging spinal canal, so that it can be used as treatment option both for congenital and degenerative spinal canal stenosis (Oertel, 2006). After surgical treatment, good or excellent results and return to pre-morbid activity levels have been reported in 60 to 85% of cases (Postacchini, 1999; Jolles, 2001; Cornefjord, 2000). Fu YS et al. showed good results in 89% and fair in 11% of patients undergoing window technique and good results in 63%, fair in 30% and poor in 7% of patients undergoing laminectomy (Fu, 2008).

In this study, Good outcome was found to be higher 76 (89.4%) in patients with laminotomy as compared to the patients with laminectomy 53 (62.4%) (p-value 0.001). Somewhat similar results were found in other studies as well. Male and female gender had significant improvement with same degree in relation to laminotomy versus laminectomy and no difference was found among these two groups. A study showed good results in 89% and fair in 11% of patients undergoing window technique and good results in 63%, fair in 30% and poor in 7% of patients undergoing laminectomy. The Maine Lumbar Spine Study prospectively compared surgical with medical treatment in 148 patients with lumbar stenosis and found at 1-year follow-up that 55% of the surgical group versus 28% of the medical group reported improvement in their symptoms (Atlas, 1996). In a more recent 4-year follow-up study in 119 of the same patients, 70% of the surgical group versus 52% of the medical group reported that their predominant symptom was improved. In addition, surgical treatment was associated with greater improvement in patient satisfaction (63%) than nonsurgical treatment (42%) at 4-year evaluation. Other studies have shown that surgical outcome correlates with the severity of preoperative stenosis (Jonsson, 1997). Meta-analysis of 74 series on lumbar stenosis demonstrated good to excellent results in 64% of cases (Turner, 1992). Longer-term (up to 8-year) outcome reviews suggest slowly decreasing levels of patient satisfaction,<sup>[18]</sup> which may be associated with bone re-growth in some cases (Postacchini, 1992).

Despite adequate decompression, some patients may not be able to resume work requiring heavy physical labor. Patients with advanced chronic radicular neurologic deficits associated with muscle atrophy are unlikely to recover fully. Low back pain in the paravertebral area, which may be due to underlying degenerative arthritis rather than to an entrapment radiculopathy, is the least likely symptom to be relieved by decompressive surgery (Grabias, 1980; Jonsson, 1991). however, in many patients surgery eliminates the preoperative claudication-like low back and sacroiliac pain worsened by ambulation.

## CONCLUSION

Surgical outcomes of Laminotomy was found to be better than Laminectomy in surgical management of lumbar spinal stenosis.

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