



Original Article

## Success and Complications of Microsurgical Over-Top Decompression for Lumbar Spine Stenosis: Experience in a Limited Resource Center

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### ABSTRACT

**Objective:** The overtop decompression is also called the outside-in technique or bilateral decompression from the unilateral approach. The objective of the study was to evaluate the success and complications of microsurgical over-top decompression for single-level lumbar spine stenosis.

**Material and Methods:** This observational study was conducted at the Neurosurgery unit at Lady Reading Hospital Peshawar from Jan 2018 to December 2021. All those patients who had undergone over-top decompression for single-level degenerative lumbar spine stenosis irrespective of age and gender were included in our study.

**Results:** We had a total of 187 patients who underwent microscopic over-top decompression for lumbar spine stenosis. Four patients lost their final follow-up. The mean age of the patients was 46 years (ranging from 18 – 68 years). Spinal stenosis was more common in men (58.3%) and at L4/5 (51.87%) level. The mean duration of surgery was 56 minutes (range 35-86 minutes). Leg pain improved in 83.1% of the cases with overall patient satisfaction after surgery in 82.5% of the cases. The most common (6.95%) complication of the procedure was iatrogenic durotomy. Most of the complications were minor and treated conservatively.

**Conclusions:** Overtop decompression is a safe and effective minimally invasive procedure for lumbar spine stenosis. It has good results in symptomatic improvement. There is minimal soft tissue and bony dissection. Therefore, mobility and stability of the spine are preserved. Moreover, the learning curve for microscopic overtop decompression is shallow and surgery time is short.

**Keywords:** Bilateral Laminectomy, Decompression, Degenerative Spine, Lumbar Spine, Lumbar Stenosis, Minimally Invasive, Spine Surgery, Unilateral Laminotomy.

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## INTRODUCTION

Lumbar spine stenosis is a common spine disorder that affects the quality of life and causes disability.<sup>1</sup> The number of cases of lumbar spine stenosis is increasing due to the aging population, improved diagnostic tools, and health care facilities. Most patients with lumbar spine stenosis are treated conservatively. Surgery is indicated when conservative management fails or patients develop progressive neurology.<sup>2-5</sup>

The objective of surgery in lumbar spinal stenosis is to decompress neuronal tissue and improve symptoms without destabilizing the spine. Decompression can best be achieved with conventional laminectomy. However, because of bony decompression and extensive soft tissue dissection, the patient is prone to develop spine instability and failed back syndrome.<sup>4,6</sup> To solve this issue, minimal invasive decompression procedures were introduced. These minimally invasive procedures are hemi laminotomy, interlaminar decompression, interspinous spacers, endoscopic decompression, and unilateral laminectomy for bilateral decompression, also called over-top decompression.<sup>1,7</sup> McCulloch and Young<sup>8-9</sup> introduced unilateral laminectomy for bilateral decompression several decades ago. However, this procedure got popular after the development of the microscope and specialized micro-instruments. As overtop, decompression requires a unilateral approach and muscle dissection, therefore, the integrity of the contralateral spinal muscles is preserved.<sup>10,11</sup> This leads to fewer chances of iatrogenic spine instability and the need for spine fusion which itself is a risk factor for adjacent level spine degeneration.<sup>12-14</sup>

Our study aimed to evaluate the success and complications of microscopic over-top decompression (unilateral laminotomy for bilateral decompression) (ULBD) for lumbar spine stenosis and to compare the outcome with other decompression procedures mentioned in the literature.

## MATERIAL AND METHODS

### Study Design

Observational study.

### Settings

The study was conducted at the Department of Neurosurgery at Lady Reading Hospital Peshawar from Jan 2018 to December 2021.

### Inclusion Criteria

All those patients who had undergone over-top decompression for single-level degenerative lumbar spine stenosis irrespective of their age and gender were included in our study.

### Exclusion Criteria

Patients with lumbar spinal stenosis associated with scoliosis, spondylolisthesis, recurrent stenosis, multiple level stenosis, stenosis requiring fusion, bilateral far lateral foramen stenosis, and congenital stenosis with short pedicle were excluded from the study.

Approval from the hospital ethical committee was taken. Informed consent was taken from the patients. The patient was followed up for 3 months after surgery.

### Data Analyses

The data was from the hospital record and entered in a specially designed Performa. Patients' data was analyzed using SPSS version 21.

### Surgical Steps of Microscopic Over-Top Decompression (also called ULBD)

The patient is given either general or spinal anesthesia and is put in the prone position on Jackson or Andrews operating table. The level is confirmed with an image intensifier (C arm), after cleaning and draping. The side of the approach

depends on the position of the spinous process (opposite to the deviated side), symptoms (pathologic side), and surgeon choice. Using a microscope or magnifying loop, a posterior midline or paramedian incision is given to the skin and thoracolumbar fascia. Ipsilateral muscle dissection is done. Then self-retaining hemilaminectomy retractor (Markham and Myerding or William retractor) is placed to retract muscle and expose the ipsilateral lamina and spinous process. With the help of Kerrison (up-cut) rongeurs and a high-speed drill, hemilaminotomy is performed to the extent to release ligamentum flavum and also undercutting of the spinous process to release contralateral ligamentum flavum. Then bilateral ligamentum flavectomy is performed from the ipsilateral approach. Further dissection is performed by cutting the medial part of facet joints till the central canal and lateral recess are decompressed. Then wound is closed in four layers. The thoracolumbar fascia and soft are closed in two layers then subcutaneous tissue and finally skin with polypropylene 2/0 suture or staples.<sup>9,11</sup>

## RESULTS

We had a total of 187 patients during the study period who full fill the inclusion criteria. Out of these, 4 patients lost to follow-up. So complete data was collected from only 183 patients. The rest of the patients had limited data available.

### Gender of Patients

We had 109/187 (58.3%) male patients and 78/187 (41.7%) female patients. The male to female ratio was 1.4: 1.

### Age Distribution

The age of the patients ranged from 18 – 69 years with a mean age of 46 years.

## Presenting Features before Surgery

Low back pain in 79.8% (149/187), leg symptoms (pain/numbness) in all (187/187) patients, and motor weakness in 11.8 % (21/187) of the cases.

## Spinal Level Involved

The spinal level involved is given in **table 1**.

**Table 1:** level of lumbar stenosis.

Spinal Level	Number of Patients	Percentage
L1/2	01	0.53%
L2/3	09	4.81%
L3/4	52	27.81%
L4/5	97	51.87%
L5/S1	28	14.97%
<b>Total</b>	<b>187</b>	<b>99.99%</b>

## Duration of Surgery

In our study, the mean duration of single-level microscopic over-top decompression (bilateral decompression from unilateral approach) was 56 minutes (range 35 – 86 minutes).

## Success of Surgery

Low back pain improved in 76.5% (114/149) cases. Leg symptoms improve in (152/183) 83.1%. overall patient satisfaction in 82.5% (151/183).

## Complications of Surgery

Post-operative complications are given in **table 2**. The majority (08/13) of the dural tear occurred in 1<sup>st</sup> 20 cases. Rest 3 cases of durotomy were observed in the case of numbers 21 to 50. We had one patient with a post-operative cerebrospinal fluid (CSF) leak that was treated conservatively. One of the patients with post-op deep infection needed wound wash and the rest were treated conservatively. We did not observe spine instability in our patients during the study period.

**Table 2:** Post-operative complications.

Post-Operative Complications	Number of Patients	Percentage
Durotomy	13/187	6.95%
Cerebro-spinal fluid (CSF) leak	01/ 183 (4 pts lost follow up)	0.55%
Wound infection	06/183	3.28%
Superficial	04/183	2.19%
Deep infection	02/183	1.09%
<b>Total (complications)</b>	<b>19/183</b>	<b>10.38%</b>

## DISCUSSION

The otopop decompression is also called the outside-in technique or bilateral decompression from the unilateral approach. It can both be done with an endoscope and microscope. The main aim of this procedure is to achieve adequate decompression of neuronal tissue without additional destabilization of the spine, decrease hospital stay, and early return to work.<sup>11,15</sup>

Studies have reported that degenerative lumbar spinal stenosis is more common in men in their old age.<sup>6,16</sup> In a study of 60 patients with unilateral laminotomy for bilateral decompression (ULBD) mean age of the patient was 59.4 years and the male to female ratio was 60: 40.<sup>1</sup> In another study of 175 patients means the age of the patients was 68 years with the age range of 34 – 89 years.<sup>10</sup> We observed in our study that lumbar spinal stenosis is also common in men but comparatively in young people. This may be because most of our population is comprised of young people and secondly men are mainly responsible for earning and supporting their families. Therefore, either sedentary life as in offices or heavy manual work (labor) prone the spine to early degeneration and stenosis.

It has been observed in different studies that lumbar spinal stenosis is more common at Lumber 4 and 5 levels.<sup>4,15</sup> The exact reason is not clear but may be because it is a more mobile part of the lumbar spine and the pedicles are short here, leading to early degeneration of the facet joints and stenosis. El-Morshidy and colleagues<sup>17</sup>

reported that lumbar spinal stenosis is more common at the L4/5 level followed by L3/4 and L5S1 levels. In another study of 92 patients who had undergone surgery for lumbar spine stenosis and was observed that the most common level involved were L4/5, followed by L3-4 and L5-S1. In this study 67.7% of the cases involved L4 to S1 levels.<sup>15</sup> We have comparable results here also. The most common level involved in our patients was lumber 4/5 (52%) followed by lumber 3/ 4 (33%) and lumber 5/S1 (15%).

The time duration of surgery depends upon the nature of the procedure, the number of levels involved, and the expertise of the operating team. In one of the studies, the mean operative time for single-level lumbar spine stenosis was 83 minutes.<sup>1</sup> In a review study it was observed that the operation time for endoscopic bilateral decompression from a unilateral approach was 72 minutes.<sup>18</sup> In another such study, the average duration of the surgery was 89 ± 56.9 minutes (range, 50 – 190 minutes).<sup>6</sup> The mean duration of surgery in our study was 56 minutes (range 35 – 86 minutes). So, we have comparatively less operative time and thus decreased the cost of the procedure.

In our study, back symptoms (pain) improved in 76.5% of the cases after surgery. Improvement in leg pain was observed in 83.9% of the patients and overall patient satisfaction in 82.2%. Our results can be compared with other studies which have also reported good overall satisfaction with the procedure and a reduction in visual analog scale.<sup>19</sup> Boogert and colleagues<sup>10</sup> studied 175 patients who had undergone decompression from either bilateral or unilateral approach for lumbar spine stenosis. They reported that back symptoms and leg pain improved in 75% and 85.4% of the cases respectively and the overall satisfactory outcome was observed in 82.1% of patients who undergone otopop decompression (bilateral decompression from unilateral approach).

In our study, the most common (7%)

complication during surgery was iatrogenic durotomy. Followed by a post-operative wound infection. Only one patient (0.6%) had a postoperative cerebrospinal fluid leak which was treated conservatively. Spine instability was observed in none of our patients. The overall complication rate in our study was almost 11%. It has been reported that the complication rates with endoscopic decompression for lumbar spine stenosis range from 5.5% to 13.8%, with dural tear having the highest incidence.<sup>18</sup> In one of the studies, incidental durotomy was observed in 8.6% of cases<sup>20-21</sup>. Çavuşoğlu and colleagues<sup>22</sup> reported that incidental durotomy is almost between 3.5 to 12% of the cases. Kim et al. common complication in their study was dural tear (7.2%). So, our complications are comparable to the standards.

Surgical site infection (SSI) increases morbidity, hospital stay, and cost of treatment. literature reported that SSI infection in spine surgery varies from 0.2% to 16.9% depending upon the type of procedure, use of implants, age of patients, duration of surgery, and presence of other comorbid conditions such as diabetes, smoking, malnutrition, and obesity.<sup>23-25</sup> Wound infection superficial to lumbar fascia is called superficial infection and deep to lumbar fascia is called deep infection.<sup>26</sup> In our study, we observed postoperative infection in 3.4% (6/174) cases. Of these patients, only two had a deep infection in the form of discitis. All these patients with post-op infection were treated conservatively except for one patient who needed spine fixation. Some of the studies have reported that both unilateral approach and standard laminectomy for decompression of lumbar spine stenosis have comparable results.<sup>27-28</sup>

Like microscopic overtop spine decompression, endoscopic surgery is less invasive and results in early return to life.<sup>29-30</sup> The learning curve is shallow for overtopping decompression as compared to endoscopic spine decompression. In our study, most of the cases of

dural tear occurred in the initial 15 cases. The rest of the two occurred in the mid and at the end of the study period. The last one occurred due to faulty Kerrison rongeurs. It has been published that the learning curve for the endoscopic decompressive procedure is steep and needs more experience but a good surgical outcome. It ranges from 30 to 100 cases.<sup>30,31</sup> Therefore, the learning curve in our study is comparatively shallow and is restricted to 15 to 20 cases.

## CONCLUSION

The overtop decompression technique for lumbar spine stenosis is a safe and effective minimally invasive procedure. Like conventional laminectomy and other minimal invasive decompressive procedures, its results are good in symptomatic improvement. Like other minimal invasive decompressive procedures, there is minimal soft tissue and bony dissection. Therefore, mobility and stability of the spine are preserved. Moreover, the learning curve for microscopic overtop decompression is shallow and surgery time is short, unlike other minimally invasive procedures.

## Limitation of the Study

This is a simple observational study and may need a cohort or randomized controlled study in future

## Disclosure

Nothing to disclose.

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### Additional Information

**Disclosures:** Authors report no conflict of interest.

**Ethical Review Board Approval:** The study was conformed to the ethical review board requirements.

**Human Subjects:** Consent was obtained by all patients/participants in this study.

**Conflicts of Interest:**

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

**Financial Relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

**Other Relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

### AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Seema Sharafat	1. Study design, methodology and quality insurer.
2.	Zahid Khan	2. Paper writing, literature review and referencing
3.	Haidar Sulaiman	3. Data collection and calculations.
4.	Farooq Azam	4. Analysis of data and interpretation of results.