

# Evaluation Of Different Surgical Modalities In The Management Of Lumbar Canal Stenosis

K Kenawy, K Ebrahim, A Darwish

## Citation

K Kenawy, K Ebrahim, A Darwish. *Evaluation Of Different Surgical Modalities In The Management Of Lumbar Canal Stenosis*. The Internet Journal of Neurosurgery. 2020 Volume 16 Number 1.

DOI: [10.5580/IJNS.54839](https://doi.org/10.5580/IJNS.54839)

## Abstract

**Background:** Spinal canal stenosis is one of the most common conditions in the elderly. It is defined as a narrowing of the spinal canal. The main cause of lumbar spinal stenosis is progressive segmental degeneration. From a patho-anatomical and patho-physiological point of view, disc degeneration lead to loss of segmental height, with disc protrusion and ensuing narrowing of the spinal canal.

**Aim of the study:** The aim of this study is to evaluate the safety and efficacy of different surgical modalities in management of degenerative lumbar canal stenosis, and to compare between surgical results with decompression plus or minus fixation.

**Study design:** Clinical prospective study.

**Patients and methods:** A prospective comparative study was done between January 2015 and December 2017, including 60 consecutive patients with degenerative lumbar canal stenosis divided into three groups: Group A: consist of 20 patients with degenerative lumbar canal stenosis treated by laminectomy and facetectomy with transpedicular screws with or without interbody fusion. Group B: consist of 20 patients with degenerative lumbar canal stenosis treated by laminectomy alone. Group C: consist of 20 patients with degenerative lumbar canal stenosis treated by bilateral fenestration and foraminotomy, or interlaminar decompression. The patients of this study were operated upon in El Demerdash Hospital (Ain Shams University hospital) and other hospitals (Dar El Shefa Hospital) (Sohag university hospital). The follow up period of these cases continued to 12 months after surgery.

**Results:** The data collected were tabulated and analyzed by SPSS (statistical package for the social science software) statistical package version 16 (2005) on IBM compatible computer. The mean value of VAS for back pain 3 and 6 months post-operative for group A treated by laminectomy and fixation, group B treated by laminectomy and group C treated minimal invasive when compared with each other were insignificant statistically. The mean value of ODI 3 months post operative for group A treated by laminectomy and fixation when compared with group B treated by laminectomy was significant statistically ( $P1 < 0.05$  S).

**Conclusion:** There is no ideal surgical modality to treat lumbar spinal canal stenosis, but we have to tailor surgical technique according to the patient presentation. The element of back pain must be respected, and the preoperative VAS for back pain should be compared with the preoperative VAS for leg pain, spinal fixation should be highly considered for these patients. as the traditional modalities will not improve the back pain.

## INTRODUCTION:

Lumbar canal stenosis is one of the most common conditions in the elderly and has been defined as a narrowing of the spinal canal.<sup>1</sup>

From a pathoanatomical and pathophysiological perspective, disc degeneration with loss of segmental height and disc

protrusion is the main cause of stenosis. Furthermore, the loss of segmental height also narrows the neural foramina and causes increasing protrusion of the dorsal ligamentous structures into the spinal canal. On the other hand, this altered biomechanical situation promotes progressive arthrosis of the intervertebral joints with reactive ligamenta lava hypertrophy adding more to the narrowing of the spinal

canal and the lateral recesses<sup>2</sup>.

And hence, narrowing of the spinal canal can occur in the central portion, lateral recess, or foramen with the produced symptoms vary by the location of the neural compression. Central canal stenosis typically present with neurogenic claudication, whereas lateral recess and foraminal stenosis present with radicular pain.<sup>3</sup>

Surgery for lumbar spinal stenosis (LSS) is generally accepted when conservative treatment has failed or if the stenosis substantially impacts on the patients' active daily living (ADL)<sup>4</sup>. Surgery for spinal stenosis consists of either decompression alone, or decompression with spinal fusion. Decompression by laminectomy is the treatment of choice for central or lateral recess stenosis. On the other hand, fusion is required if foraminal stenosis is present. During the decompressive surgery, specific attention should be paid not to injure the pars interarticularis<sup>5</sup>. On the other hand, minimally invasive techniques had the advantage of preserving the paraspinal muscle, spinous processes, supraspinous and interspinous ligaments<sup>6</sup>. A microscope or magnifying loupes and tubular retractor system are helpful.<sup>7</sup>

**Aim of the study:** The aim of this study is to review and evaluate the different surgical modalities in management of degenerative lumbar canal stenosis, and assessment of post-operative outcome.

### **PATIENTS AND METHODS:**

This is a prospective descriptive study that has been conducted between January 2015 and December 2017, including 60 patients diagnosed to have degenerative lumbar canal stenosis that needed surgical intervention. All patients were submitted to complete history taking, clinical examination, routine labs, and radiological investigation. Enrolled patients were further divided into three groups:

**Group A:** consisted of 20 patients with degenerative lumbar canal stenosis treated by laminectomy (removal of the whole lamina with or without removal of pars interarticularis) and facetectomy with transpedicular screws with or without interbody fusion.

**Group B:** consisted of 20 patients with degenerative lumbar canal stenosis treated by laminectomy (removal of the whole lamina without affection of pars interarticularis) without facetectomy and no use of any hardware.

**Group C:** consisted of 20 patients with degenerative lumbar canal stenosis treated by bilateral fenestration and

foraminotomy, or interlaminar decompression.

The patients of this study were operated upon in El Demerdash Hospital (Ain Shams University hospital) and other hospitals (Dar El Shefa Hospital and Nasser Institute, Sohag university hospital).

The follow up period of these cases continued to 12 months after surgery.

Patients enrolled in this study have been assessed preoperatively and postoperatively for 6-12 months with Oswestry Disability Index (ODI) , Visual Analog Scale (VAS) for low back pain (LBP) , Visual Analog Scale for Leg pain and claudication and neurological status. Any adverse events or implant related complications (e.g. breaking of implants, dislocation) as well as surgical revisions or additional stabilizations have been recorded.

Beside a fixed preoperative Magnetic Resonance Imaging (MRI) that was done for all patients to demonstrate any impingement of the central spinal canal, lateral recess and the foramen from disc herniation, ligament flavum hypertrophy and facet joint hypertrophy, preoperative Computed Tomography (CT) was done to provide more precise information about bony compression.

Plain X-rays lumbo-sacral spine antero-posterior and lateral views as well as flexion-extension lateral radiographs taken in the standing position were done pre and postoperatively to discover translatory instability in the main segment as well as in adjacent segments.

**Statistical analysis:** This was done using SPSS (statistical package for the social science software) statistical package version 16 (2005) on IBM compatible computer. Description of all quantitative variables was in the form of mean, standard deviation and range. Description of all qualitative variables was in the form of number and percentage. Comparison of quantitative variables was done by T-test (student t-test of two independent samples to compare between two quantitative variables) paired T-test or nonparametric test, as appropriate. Comparison of qualitative variables was done by Chi-square (X<sup>2</sup>) test.

### **RESULTS:**

#### ***Patients characteristics:***

Demographic characteristics of 3 groups of patients as regard age , gender and comorbidities have been analyzed as summarized in table (1) showing no statistically

significant difference among those groups.

**Table 1**

Demographic characteristics (age, sex and Comorbidity) of group A (treated by laminectomy and fixation), group B (treated by laminectomy) and group C (treated minimal invasive).

variable	Studied group			F test	P value	Final Hoc test
	Group A (n=20)	Group B (n=20)	Group C (n=20)			
<b>Age</b>						
Mean ±SEM	47.9± 1.86	50.75 ± 1.9	51.85 ± 2.8		>0.05	P1 > 0.05 NS P2 >0.05 NS
Range	33-64	38-66	35-70	0.97	NS	P3 > 0.05 NS
<b>Sex</b>	NO %	NO %	NO %			P1 > 0.05 NS
Male	14 (70%)	11 (55%)	13 (65%)	$\chi^2$ test	>0.05	P2 >0.05 NS
Female	6 (30%)	9 (45%)	7 (35%)	1.05	NS	P3 > 0.05 NS
<b>Comor-bidity</b>	NO %	NO %	NO %			P1 > 0.05 NS
+ ve	9 (45%)	9 (45%)	8 (40%)	$\chi^2$ test	>0.05	P2 >0.05 NS
-ve	11 (55%)	11 (55%)	12 (60%)	0.14	NS	P3 > 0.05 NS

**Changes in the clinical parameters before and after intervention:**

Regarding the visual analogue scale for back pain. table (2), the mean value of VAS for back pain 3 and 6 months post operative for group A treated by laminectomy and fixation, group B treated by laminectomy and group C treated minimally invasive when compared with each other were insignificant statistically.

The mean value of VAS for back pain one year post-operative was statistically significantly higher (P1 < 0.001 HS) in group A treated by laminectomy and fixation when compared with group B treated by laminectomy, also the mean value of VAS for back pain one year post-operative was statistically significantly higher (P2 < 0.001 HS) in group A treated by laminectomy and fixation when compared with group C treated minimally invasive.

**Table 2**

Comparison between group A treated by laminectomy and fixation, group B treated by laminectomy and group C treated minimal invasive; Regarding the visual analogue scale for back pain preoperative, 3 months post-operative, 6 months post-operative and one-year post-operative.

Variable	Group A (n=20)	Group B (n=20)	Group C (n=20)	F test	P value	Final Hoc test
<b>VAS for back pain preoperative</b>						
Mean ±SEM	7.55 ± 0.15 <sup>1,2</sup>	4.5 ± 0.19 <sup>3</sup>	4.05 ± 0.2	103.9	<0.001 HS	P1 < 0.001 HS P2 <0.001 HS P3 > 0.05 NS
Range	6-9	3-6	3-6			
<b>VAS for back pain 3 months postoperative</b>						
Mean ±SEM	3 ± 0.19	3.1 ± 0.16	3 ± 0.16	0.112	> 0.05 NS	P1 > 0.05 NS P2 > 0.05 NS P3 > 0.05 NS
Range	2-5	2-5	2-5			
<b>VAS for back pain 6 months postoperative</b>						
Mean ±SEM	2.2 ± 0.15	2.7 ± 0.19	2.6 ± 0.15	3.1	> 0.05 NS	P1 > 0.05 NS P2 > 0.05 NS P3 > 0.05 NS
Range	1-4	2-5	2-4			
<b>VAS for back pain one-year postoperative</b>						
Mean ±SEM	1.8 ± 0.14	2.8±0.26	2.5 ± 0.15	7.6	<0.001 HS	P1 < 0.001HS P2 <0.001 HS P3 > 0.05 NS
Range	1-3	2-6	1-4			

Regarding the visual analogue scale for leg pain (table 3), the mean value of leg pain preoperative, 3 months post-operative, 6 months post-operative and one year post-operative in group A treated by laminectomy and fixation, group B treated by laminectomy and group C treated minimal invasive when compared with each other were statistically insignificant.

**Table 3**

Comparison between group A treated by laminectomy and fixation, group B treated by laminectomy and group C treated minimal invasive. Regarding the visual analogue scale for leg pain preoperative, 3 months post-operative, 6 months post-operative and one-year post-operative.

Variable	Group A (n=20)	Group B (n=20)	Group C (n=20)	F test	P value	Final Hoc test
<b>VAS for leg pain preoperative</b>						
Mean ±SEM	7.2 ± 0.19 <sup>1,2</sup>	7.5 ± 0.13	7.05 ± 0.17	1.5	> 0.05 NS	P1 > 0.05 NS P2 > 0.05 NS P3 > 0.05 NS
Range	6-8	6-8	6-8			
<b>VAS for leg pain 3 months postoperative</b>						
Mean ±SEM	1.8 ± 0.1	2.00 ± 0.00	1.9 ± 0.05	0.88	> 0.05 NS	P1 > 0.05 NS P2 > 0.05 NS P3 > 0.05 NS
Range	1-3	2-2	1-2			
<b>VAS for leg pain 6 months postoperative</b>						
Mean ±SEM	1.3 ± 0.2	1.5 ± 0.1	1.6 ± 0.1	0.46	> 0.05 NS	P1 > 0.05 NS P2 > 0.05 NS P3 > 0.05 NS
Range	1-5	1-2	1-2			
<b>VAS for leg pain one year postoperative</b>						
Mean ±SEM	1.2 ± 0.2	1.4±0.4	1.3 ± 0.1	0.26	> 0.05 NS	P1 > 0.05 NS P2 > 0.05 NS P3 > 0.05 NS
Range	1-5	1-2	1-2			

Regarding the Oswestry Disability Index (ODI), the mean

value of ODI 3 months post-operative for group A treated by laminectomy and fixation when compared with group B treated by laminectomy was significant statistically ( $P1 < 0.05$  S) while when compared with group C treated minimal invasive was statistically insignificant ( $P2 > 0.05$  NS). The mean value of ODI 3 months post-operative for group B treated by laminectomy when compared with group C treated minimal invasive was statistically insignificant ( $P3 > 0.05$  NS).

The mean value of ODI 6 months post-operative for group A treated by laminectomy and fixation when compared with group B treated by laminectomy was insignificant statistically ( $P1 > 0.05$  NS), also for group A treated by laminectomy and fixation when compared with group C treated minimal invasive was insignificant statistically ( $P2 > 0.05$  NS), while for group B treated by laminectomy when compared with group C treated minimal invasive was statistically significant ( $P3 < 0.05$  S).

The mean value of ODI one year post-operative for group A treated by laminectomy and fixation when compared with group B treated by laminectomy was significant statistically ( $P1 < 0.05$  S), while for group A treated by laminectomy and fixation when compared with group C treated minimal invasive was insignificant statistically ( $P2 > 0.05$  NS), but for group B treated by laminectomy when compared with group C treated minimal invasive was significant statistically ( $P3 < 0.05$  S). Table(4)

**Table 4**

Comparison between group A treated by laminectomy and fixation, group B treated by laminectomy and group C treated minimal invasive. Regarding the Oswestry Disability Index (ODI) preoperative, 3 months post-operative, 6 months post-operative and one year post-operative.

Variable	Group A (n=25)	Group B (n=25)	Group C (n=25)	F test	P value	Final Hoc test
<b>ODI preoperative</b> Mean $\pm$ SEM Range	42.6 $\pm$ 1.3 <sup>HS2</sup> 34-60	35.5 $\pm$ 1.1 <sup>S3</sup> 26-42	33.9 $\pm$ 1.4 24-44	12.9	<0.001 HS	P1 < 0.001 HS P2 < 0.001 HS P3 > 0.05 NS
<b>ODI 3 months post-operative</b> Mean $\pm$ SEM Range	12 $\pm$ 0.5 <sup>S12</sup> 10 - 18	14.1 $\pm$ 0.5 <sup>S3</sup> 10 - 20	12.9 $\pm$ 0.6 8 - 20	3.4	< 0.05 S	P1 < 0.05 S P2 > 0.05 NS P3 > 0.05 NS
<b>ODI 6 months post-operative</b> Mean $\pm$ SEM Range	10.1 $\pm$ 0.6 <sup>S12</sup> 8- 20	11.7 $\pm$ 0.7 <sup>S3</sup> 8- 20	9.5 $\pm$ 0.35 6- 12	3.7	< 0.05 S	P1 > 0.05 NS P2 > 0.05 NS P3 < 0.05 S
<b>ODI one year post-operative</b> Mean $\pm$ SEM Range	8.7 $\pm$ 0.9 <sup>S12</sup> 6 - 24	12.2 $\pm$ 1.2 <sup>S3</sup> 8 - 28	8.7 $\pm$ 0.4 6- 12	4.6	< 0.05 S	P1 < 0.05 S P2 > 0.05 NS P3 < 0.05 S

The mean value of number of segments involved in surgical treatment was statistically significant ( $P1 < 0.05$  S) in group A treated by laminectomy and fixation when compared with group B treated by laminectomy, also the mean value of number of segments involved in surgical treatment was statistically significant ( $P2 < 0.05$  S) in group A treated by laminectomy and fixation when compared with group C treated minimal invasive. While the mean value of number of segments involved in surgical treatment was statistically insignificant ( $P3 > 0.05$  NS) in group B treated with laminectomy when compared with group C treated minimal invasive.

The mean value of operative time taken during surgery was statistically significantly higher ( $P1 < 0.001$ HS) in group A treated by laminectomy and fixation when compared with group B treated by laminectomy, also the mean value of operative time taken during surgery was statistically significantly higher ( $P2 < 0.001$  HS) in group A treated by laminectomy and fixation when compared with group C treated minimal invasive. While the mean value of operative time taken during surgery was statistically insignificant ( $P3 > 0.05$  NS) in group B treated with laminectomy when compared with group C treated minimal invasive.

The mean value of hospital stay was statistically significantly higher ( $P1 < 0.001$ HS) in group A treated by laminectomy and fixation when compared with group B treated by laminectomy, also the mean value of hospital stay

was statistically significantly higher ( $P2 < 0.001$  HS) in group A treated by laminectomy and fixation when compared with group C treated minimal invasive. While the mean value of hospital stay was statistically insignificant ( $P3 > 0.05$  NS) in group B treated with laminectomy when compared with group C treated minimal invasive. These data has been summarized in table (5):

**Table 5**

Comparison between group A treated by laminectomy and fixation, group B treated by laminectomy and group C treated minimal invasive. Regarding number of segments involved in surgical treatment, operative time, and hospital stay.

Variable	Group A (n=20)	Group B (n=20)	Group C (n=20)	F test	P value	Final Hoc test
Number of segment involved Mean $\pm$ SEM Range	2.15 $\pm$ 0.27* <sup>142</sup> 1 - 5	1.40 $\pm$ 0.12* <sup>1-#3</sup> 1 - 2	1.30 $\pm$ 0.10 1 - 2	6.95	< 0.05 S	P1 < 0.05S P2 < 0.05 S P3 > 0.05 NS
Operative time Mean $\pm$ SEM Range	3.0 $\pm$ 0.16* <sup>192</sup> 2 - 4	1.95 $\pm$ 0.17* <sup>93</sup> 1 - 3	1.7 $\pm$ 0.15 1 - 3	18.6	< 0.001 HS	P1 < 0.001HS P2 < 0.001 HS P3 > 0.05 NS
Hospital stay Mean $\pm$ SEM Range	3.8 $\pm$ 0.27* <sup>142</sup> 3 - 8	2.45 $\pm$ 0.13* <sup>93</sup> 1 - 4	1.85 $\pm$ 0.23 1 - 5	20.7 8	< 0.001 HS	P1 < 0.001 HS P2 < 0.001 HS P3 > 0.05 NS

The mean value of the presence of neurological deficit preoperative and complication post-operative in group A treated by laminectomy and fixation, group B treated by laminectomy and group C treated minimal invasive when compared with each other were insignificant statistically. Table (6):

**Table 6**

Comparison between group A treated by laminectomy and fixation, group B treated by laminectomy and group C treated minimal invasive; regarding the presence of neurological deficit preoperative and complication post-operative.

Variable	Group A (n=20)		Group B (n=20)		Group C (n=20)		X <sup>2</sup> Test	
	NO	%	NO	%	NO	%		
<b>Deficit</b>							1.4	P1 > 0.05 NS P2 > 0.05 NS P3 > 0.05 NS
+ve (present)	3	15	6	30	4	20		
-ve (absent)	17	85	14	70	16	80		
<b>complication</b>							9.03	P1 > 0.05 NS P2 > 0.05 NS P3 > 0.05 NS
none	17	85	17	85	18	90		
dural tear	1	5	0	0	2	10		
wound infection	1	5	1	5	0	0		
back pain	0	0	2	10	0	0		
leg pain	1	5	0	0	0	0		

**DISCUSSION**

The surgical aim of treatment for symptomatic lumbar canal stenosis is relief of symptoms by adequate neural decompression while preserving much of the anatomy and the biomechanical function of the lumbar spine.<sup>8</sup>

It is clear that patients with severe LSS with significant symptoms can benefit from lumbar decompressive surgery. However, whether patients with moderate LSS with less severe symptoms should also have surgery is unclear. A randomized, controlled study of 94 patients with moderate LSS who underwent either surgical or non-surgical treatment suggested that decompressive surgery of moderate lumbar spinal stenosis can provide slight, but consistent, functional ability improvement.<sup>22</sup>

North American Spine Society (NASS) guidelines suggest the use of decompressive surgery as a mean of improving outcome not only in patients with severe symptoms of LSS but in those with moderate symptoms as well.<sup>13</sup>

The SPORT group also included a trial of patients with lumbar spinal stenosis in the absence of spondylolisthesis who were randomized to decompression surgery without fusion or standard non operative care. This trial included 289 patients were enrolled from 13 centers across the United States. It showed a benefit to surgery in all primary outcomes that was sustained at 2 years.<sup>16</sup>

Nasca RJ has recommended that an arthrodesis be performed when stenosis is associated with instability or in the setting of a spondylotic spine associated with complaints of low back pain.<sup>17</sup>

There is a higher rate of complications in instrumented fusions in the elderly patients, such as pseudarthrosis, implant failure due to loosening and complications because of the co-morbidity of the patients.<sup>15</sup>

Fenestration with minimal soft tissue dissection and limited bone removal instead of extensive laminectomy to prevent subsequent lumbar instability has become widely accepted for the treatment of spinal stenosis. A unilateral approach for bilateral decompression has been modified and performed successfully by many surgeons.<sup>23</sup>

**Evaluation of postoperative data:**

**1- VAS for Low Back Pain:**

One study evaluating the benefit of laminectomy with or

without arthrodesis found that those with a fusion had a significant improvement in back pain at 2 months compared to those treated with decompression alone; however, in all other outcome measures there was no benefit to the addition of a fusion.<sup>24</sup>

Other authors in prospective observational studies have reported that in patients with stenosis decompression and arthrodesis versus laminectomy alone led to greater relief of back pain at 2-year follow-up.<sup>12</sup>

Rampersaud et al described a retrospective observational cohort study with 90 patients, 28 presented with leg pain with no instability or mechanical back pain for which decompression alone was selected. For the 62 patients with leg symptoms and mechanical back pain with or without documented instability, fusion was added to the compression treatment. No significant differences were found between the health and quality of life benefits for the two groups of spinal surgery patients.<sup>21</sup>

In this study, there is significant improvement of VAS for back pain post-operative for the group A treated with laminectomy and fixation with the mean  $7.55 \pm 0.15$  preoperative and  $1.8 \pm 0.14$  one year post-operative. To be considered that patients with severe back pain preoperative were directed to group A to be treated with laminectomy and fixation, while patients with mild to moderate back pain were directed to group B and C to be treated by traditional laminectomy or minimally invasive surgery.

For group B there is moderate improvement of VAS for back pain post-operative with mean  $4.5 \pm 0.19$  preoperative and  $2.8 \pm 0.26$  one-year post-operative. Also, for group C treated minimally invasive there is moderate improvement of VAS for back pain post-operative with the mean  $4.05 \pm 0.2$  preoperative and  $2.5 \pm 0.15$  one year postoperative.

### **2- VAS for Leg Pain:**

In the Rajendra Nath et al study, most of the patients (87.5%) had presented with posture related severe leg pain, but postoperatively 96.87% patients had no leg pain. All patients had preoperative claudication distance less than 100 m, but 93.75% patients had normal gait with walking distance more than 500 m and no claudication symptoms postoperatively. 93.74% patients had abnormal straight leg raising test, but postoperatively all patients had normal straight leg raising test.<sup>20</sup>

In this study, there was significant improvement of leg pain

in the three groups, with no significant difference between them.

In group A (fixation added to laminectomy) the mean of VAS for leg pain was  $7.2 \pm 0.19$  preoperative, 3 months later was  $1.8 \pm 0.1$  and one year post-operative was  $1.2 \pm 0.2$ . While in group B (laminectomy only) the mean of VAS for leg pain was  $7.5 \pm 0.13$  preoperative, 3 months later was  $2.0 \pm 0.00$  and one year post-operative was  $1.4 \pm 0.1$ . Finally in group C (minimally invasive) the mean of VAS for leg pain was  $7.05 \pm 0.17$  preoperative, 3 months post later was  $1.9 \pm 0.05$  and one year post-operative was  $1.3 \pm 0.1$ .

So there was significant improvement of leg pain and claudication pain especially by long term follow up (in this study after one year follow up), in the three groups. So the leg pain does not influence the choice of the procedure.

### **3-Oswestry Disability Index (ODI):**

Airaksinen et al conducted a retrospective review of surgical outcomes for lumbar spinal stenosis. Of the 497 patients, 438 were available for follow-up at a mean of 4.3 years. The ODI was used as an outcome measure and a masked review was performed. Overall, there were good or excellent results in 62% of patients.<sup>1</sup>

In this study, there is marked improvement of ODI for the three groups preoperative and one year post-operative. In group A treated by laminectomy and fixation the ODI preoperative was  $42.6 \pm 1.3$  and one-year post-operative was  $8.7 \pm 0.9$ . In group B treated by laminectomy only the ODI preoperative was  $35.5 \pm 1.1$  and one-year post-operative was  $12.2 \pm 1.2$ . In group C treated minimally invasively the ODI preoperative was  $33.9 \pm 1.4$  and one year post-operative was  $8.7 \pm 0.4$ .

But due to highly significant difference of ODI preoperative between group A and the other two groups B and C, the overall satisfaction in group A is better than the other two groups B and C. This is because the element of back pain in group A was more prominent beside the leg pain and walking distance preoperative, while in the other two groups B and C only the leg pain and walking distance were the main complaint preoperative.

### **4- Complications:**

#### **A- Recurrent back pain:**

In this study, there were two cases of recurrent back pain, the two cases occurred in the group B (treated by

laminectomy) with the percent of 10% from the total number of cases of this group.

In fact, the two cases were not recurrent but the element of back pain was not relieved by surgery, and increasing gradually by time and follow up with maximum increase after one year.

These two cases treated by local Facetal injection with local anesthetic and long acting steroid under C-arm in operative theater. And they improved after injection.

### ***B- Recurrent leg pain:***

In this study, there was only one case with recurrent leg pain, this case occurred in group A (treated by laminectomy and fixation) with a percent of 5% of the total cases of this group.

The leg pain started to appear again after 6 months and increasing gradually to reach the maximum after one year, in spite of medical treatment.

A new MRI lumbosacral spine with contrast was done and revealed arachnoiditis with mild adhesions around the root. The patient was sent for transforaminal radiofrequency injection and he improved.

Despite adequate decompression, substantial back and leg symptoms develop in up to 10% to 15% of patients who have undergone an adequate lumbar decompression.<sup>7</sup>

Substantial osseous regrowth after decompression may be the reason symptoms recur and can decrease patient satisfaction. In a study by Postacchini and Cinotti,<sup>40</sup> patients were treated for lumbar stenosis with an average follow-up time of 8.6 years after surgery. On the basis of AP radiographs, the amount of bone regrowth at the laminectomy site was assessed. Only 12% of patients showed no regrowth of the previously resected posterior vertebral arch, whereas 40% of the patients demonstrated more than 40% regrowth of the lamina.<sup>19</sup>

In a similar analysis, Chen and colleagues found that at 4.5 years after laminectomy, 44% of patients had moderate or marked regrowth of the lamina with spinal instability accelerating bone regrowth. Patients with moderate and marked bone regrowth had poorer clinical outcomes than those with no significant and mild bone regrowth.<sup>4</sup>

Finally, by the analysis of the whole above data we can find that the three procedure for treatment of lumbar canal

stenosis will improve the element of leg pain and walking distances with the advantage of the group A (treated by laminectomy and fixation) in improving of the back pain if it is marked prominent preoperative; also the advantages of the group C (treated minimally invasive) in early ambulation, short operative time, short hospital stay and preservation of normal bony structures and the musculature of the spine.

### **CONCLUSION:**

There is no ideal surgical modality to treat lumbar spinal canal stenosis, but we have to modulate our available modalities according to the patient presentation.

The element of back pain must be respected, and the preoperative VAS for back pain should be compared with the preoperative VAS for leg pain, as the traditional modalities will not improve the back pain.

The VAS for leg pain and claudication pain will improve almost equally by all surgical modalities, so we have to revise our concept about radical laminectomy and to put in our view the minimally invasive procedures as microscopic lumbar canal decompression through unilateral or bilateral fenestration.

### **References**

1. Airaksinen O: Surgical outcome of 438 patients treated surgically for lumbar spinal stenosis. *Spine*; 22(19):2278-82, 2010.
2. Amundsen T, Weber H, Nordal HJ, Magnaes B, Abdelnoor M and Lilleas F. Lumbar spinal stenosis: conservative or surgical management? A prospective 10-year study. *Spine*; 25:1424-35, 2000.
3. Atlas SJ, Keller RB, Robson D, Deyo RA and Singer DE: Surgical and nonsurgical management of lumbar spinal stenosis: four-year outcomes from the Maine Lumbar Spine Study. *Spine*; 25:556-562, 2000.
4. Chen Q, Baba H, and Kamitani K. Postoperative bone regrowth in lumbar spinal stenosis. A multivariate analysis of 48 patients. *Spine* 19:2144-2149, 2011.
5. Chou R, Baisden J, Carragee EJ, Resnick DK, Shaffer WO and Loeser JD: Surgery for low back pain: a review of the evidence for an American Pain Society Clinical Practice Guideline. *Spine*; 34: 1094-109, 2009.
6. Colak A, Topuz K, Kutlay M, Kaya S, and Simsek H. A less invasive surgical approach in the lumbar lateral recess stenosis: direct approach to the medial wall of the pedicle. *Eur Spine J*; 17: 1745-1751, 2008.
7. Diwan AD, Parvartaneni H and Cammisa F: Failed degenerative lumbar spine surgery. *Orthop Clin North Am* 34:309-324, 2003.
8. Haba K, Ikeda M, Soma M, and Yamashita T: Bilateral decompression of multilevel lumbar spinal stenosis through a unilateral approach. *J Clinical Neurosci*; 12(2):169-171, 2005.
9. Holinkaet J, Krepler P, Matzner M and Grohs JG.: Stabilising effect of dynamic interspinous spacers in degenerative low-grade lumbar instability. *Int Orthop*; 35: 395-400, 2010.

10. Jakola AS, Sorlie A, Gulati S, Nygaard OP, Lydersen S, et al: Clinical outcomes and safety assessment in elderly patients undergoing decompressive laminectomy for lumbar spinal stenosis: a prospective study. *BMC Surg*; 10: 34, 2010.
11. Kalff R, Ewald C, Waschke A, Gobisch L and Hopf C.: Degenerative lumbar spinal stenosis in older people: current treatment options. *Dtsch Arztebl Int*; 110: 613-623, 2013.
12. Katz JN, Lipson SJ, and Lew RA. Lumbar laminectomy alone or with instrumented or non instrumented arthrodesis in degenerative lumbar spinal stenosis. Patient selection, costs, and surgical outcomes. *Spine* 22:1123-1131, 2006.
13. Kreiner et al DS, Shaffer WO, Baisden JL, Gilbert TJ, Summers JT, Toton JF, et al: An evidence-based clinical guideline for the diagnosis and treatment of degenerative lumbar spinal stenosis (update). *Spine J.*; 13(7):734-43, 2013.
14. Lee CW, Rauschnig W and Glenn W. Lateral lumbar spine canal stenosis. *Spine*; 13:313-320, 1988.
15. Lee kk and Teo EC: effects of laminectomy and facetectomy on the stability of the lumbar motion segment. *Medical engineering and physics*; 26:183-92, 2004.
16. Malmivaara A, Slati P, and Heliövaara M. Surgical or non-operative treatment for lumbar spinal stenosis? A randomized controlled trial. *Spine*; 32:1-8, 2007.
17. Nasca RJ.: Rationale for spinal fusion in lumbar spinal stenosis. *Spine*; 14:451-454, 2005.
18. Patel C and Truumees E: Spinal Stenosis: Pathophysiology, Clinical Diagnosis, and Differential Diagnosis. In H. Herkowitz, S. Garfin, F. Eismont, G. Bell, R. Balderston and 6 (Ed.) Rothman-Simeone *THE SPINE*; Vol. 2, pp. 1064-1077), 2011 United States: Elsevier Saunders.
19. Postacchini F, Cinotti G and Perugia D.: Degenerative Lumbar Spondylolisthesis II. Surgical Treatment. *Ital J Orthop Traumatol.*; 17:467-477, 1999.
20. Rajendra Nath, Sanjay Middha, Anil Kumar Gupta, and Rohit Nath: Functional outcome of surgical management of degenerative lumbar canal stenosis. *Indian J Orthop*; 46(3): 285-290, 2012.
21. Rampersaud YR: Assessment of health-related quality of life after surgical treatment of focal symptomatic spinal stenosis compared with osteoarthritis of the hip or knee. *Spine J.*; 8(2):296-304, 2008.
22. Slätis P, Malmivaara A, Heliövaara M, Sainio P, Herno A, Kankare J, et al: Long-term results of surgery for lumbar spinal stenosis: a randomised controlled trial. *Eur Spine J.*; 20(7):1174-81, 2011.
23. Thome C, Zevgaridis D, Leheta O, Bazner H, Pockler-Schoniger C and Wohrle J: Outcome after less invasive decompression of lumbar spinal stenosis: a randomized comparison of unilateral laminotomy, bilateral laminotomy and laminectomy. *J Neurosurg Spine*; 3(2):129-141, 2005.
24. Watters WC, Baisden J, Gilbert TJ, et al: Degenerative lumbar spinal stenosis: An evidence-based clinical guideline for the diagnosis and treatment of degenerative lumbar spinal stenosis. *Spine J*; 8:305-310, 2008.
25. Wong D and Transfeldt E: Disc Degeneration Without Root Irritation: Acute and Chronic Low Back Pain. In: *Macnab's Backache*, 4th Edition. Lippincott Williams & Wilkins; P 166-244, 2007 B.
26. Wong D and Transfeldt E: Musculoskeletal Anatomy, Neuroanatomy, and Biomechanics of the Lumbar Spine. In: *Macnab's Backache*, 4th Edition. Lippincott Williams & Wilkins; P 1-20 2007 A.



**Author Information**

**Karam Kenawy**

Lecturer of Neurosurgery, Sohag University  
Sohag, Egypt

**Khaled Saeed Ebrahim**

Ass. Professor of Neurosurgery, Ain Shams University  
Cairo, Egypt

**Ahmed Darwish**

Ass. Professor of Neurosurgery, Ain Shams University  
Cairo, Egypt