Bilateral versus unilateral interlaminar approach for bilateral decompression in patients with single-level degenerative lumbar spinal stenosis: a multicenter retrospective study of 175 patients on postoperative pain, functional disability, and patient satisfaction

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OBJECT The bilateral and unilateral interlaminar techniques for bilateral decompression both demonstrate good results for the treatment of degenerative lumbar spinal stenosis (DLSS). Although there is some discussion about which approach is more effective, studies that directly compare these two popular techniques are rare. To address this shortcoming, this study compares postoperative functional disability, pain, and patient satisfaction among patients with single-level DLSS who underwent bilateral decompression using either a bilateral or unilateral approach.

METHODS This retrospective study included patients who underwent operations between November 1, 2009, and October 1, 2011. These patients underwent single-level bilateral decompressive surgery using either the bilateral or unilateral interlaminar approach at one of 5 participating hospitals. Exclusion criteria included previous lumbar surgery, additional disc surgery, and spondylolisthesis requiring fusion surgery. Primary outcome measures included bodily pain (as reported using the visual analog scale [VAS]), the Roland-Morris Disability Questionnaire (RMDQ), and the Oswestry Disability Index (ODI). In addition, reductions in leg and back symptoms and the patient’s general evaluation of the procedure were queried. Finally, patient satisfaction and surgical parameters were evaluated. Questionnaires were sent to each patient’s home, and electronic patient files were used to collect the data.

RESULTS One hundred and seventy-five patients returned the questionnaire (74.4% response rate; 68 and 107 patients who underwent the bilateral or unilateral approach, respectively). Mean age at surgery was 68 years (range 34–89 years), and the mean follow-up period was 14.2 months (range 3.3–27.4 years). There were no significant differences in ODI (20.3 vs 22.6 for the bilateral and unilateral approaches, respectively), RMDQ (3.99 vs 4.8, respectively), or pain scores between treatment groups. Back symptoms were reduced in 74.8% (bilateral: 74.6% vs unilateral: 75%; not significant), and leg symptoms in 80.6% of the patients (bilateral: 73.1% vs unilateral: 85.4%; p = 0.048). In total, 72.1% (bilateral) and 80.0% (unilateral) of patients reported good overall treatment results (p = 0.226). Significantly more patients in the unilateral group reported a better overall satisfaction with the procedure (82.1% vs 69.1%; p = 0.047).

CONCLUSIONS There were no differences in postoperative functional disability and pain between the surgical techniques. The significant differences in patient satisfaction and reduction in leg symptoms were unrelated to surgical technique. The overall treatment results were satisfactory. Both techniques are safe and effective options for treating patients with single-level DLSS.


KEY WORDS decompression; interlaminar; lumbar stenosis; unilateral; bilateral; patient satisfaction; pain; disability
The prevalence of degenerative lumbar spinal stenosis (DLSS) is rising because of aging populations, and the condition can lead to serious functional disability and a decrease in quality of life among these patients.\(^8,18,20,44,53,61\) DLSS is currently the most common indication for spinal surgery in patients older than 65 years,\(^13,19,20,53,56\) and several studies have shown better surgical results over more conservative therapies.\(^7,5,6,10,25,27,38,63\)

However, open conventional laminectomy has been criticized because of its limited success rate\(^60\) and potential for negative side effects, such as the increased risk of postoperative instability and the subsequent need for secondary fusion surgery; this is again associated with additional risks and costs.\(^15,23,28,35,36,52\) and also persistent postoperative back pain due to prolonged muscle retraction.\(^1,39,54\) As a result of these potential side effects, the development of less invasive techniques was initiated.\(^9\)

In 1988, Young et al. introduced microscope-assisted bilateral laminotomy.\(^64\) In 1999, a less invasive unilateral approach was introduced for bilateral decompression.\(^52\) Using this technique, the paraspinal muscles are unilaterally mobilized, thereby preserving the functional integrity of the contralateral muscles and inter- and supraspinous ligaments. These less invasive lumbar microsurgical decompressive techniques have shown good clinical results and, at the same time, have reduced the chance of postoperative instability.\(^9,22,34,42,46,58,59,62,64\)

However, whether or not these two techniques are equal to each other in terms of important postoperative clinical outcomes and certain surgical parameters remains unclear. A large, preferably prospective, randomized study that compares only these two techniques is lacking; however, one needs to be critical when questioning the real benefits of such a study if both treatment options demonstrate similar and promising results.

To address this question, we conducted this multicenter retrospective study to compare the bilateral and unilateral approaches for treating patients with single-level DLSS in terms of each patient’s postoperative pain, functional disability, symptom reduction and satisfaction, and certain surgical parameters.

### Methods

Patients who underwent bilateral decompression for single-level DLSS between November 2009 and October 2011 at one of 5 participating clinics were eligible for inclusion in this retrospective study. Other inclusion criteria were radiological evidence of stenosis on MRI or CT, no history of lumbar surgery, and use of the unilateral or bilateral approach as described in the next section. Patients who underwent additional surgery (e.g., lumbar disc surgery, instrumentation) were excluded. Because of the possible correlation with surgical outcomes, patients with spondylolisthesis—but who did not need any additional fusion surgery—were not excluded.\(^77\) Neurosurgeons from the participating top clinical neurosurgical center and its satellite hospital only performed the unilateral technique. At the other 3 hospitals (a university hospital with 2 satellite hospitals), only the bilateral interlaminar procedure was performed. All hospitals are high-volume spine centers, and all participating neurosurgeons had more than 3 years of surgical experience.

The participating clinics together provide all neurosurgical care in the northern part of the Netherlands, thereby increasing the chance of a geographically homogeneous research population. There are no signs that the patients chose a specific hospital because of the surgical technique, so allocation to a technique was random.

The medical ethics committees of the participating centers oversaw the entire study protocol, and written approval was obtained to perform the proposed study. Data were obtained using electronic patient files and patient-administered questionnaires. Questionnaires were sent to the patients, along with a letter explaining the purpose of the study and the role of the participants; patients provided informed consent by sending back the completed questionnaire. After 3 weeks, all nonrespondents were contacted in order to increase the response rate.

### Surgical Techniques

Positioning of the patient and anesthesia administration were performed according to the preferences of the specific institutions. For both surgical procedures, the correct level of surgery was confirmed using intraoperative imaging, and a median linear incision was made to expose the spine. All surgeries were performed in a standardized manner.

#### Bilateral Approach

The paraspinal muscles were stripped on both sides of the spinous process. The supra- and interspinous ligaments as well as a rim of bone from the caudal aspect of the cranial lamina and the cranial aspect of the caudal lamina were removed, thereby creating a larger interlaminar space. The ligamentum flavum was removed bilaterally, and the bilateral spinal recess was subsequently opened by undercutting minimal portions of the medial facet joints.

#### Unilateral Approach

The paraspinal muscles were stripped on one side without removing the supra- and interspinous ligaments. The unilateral superior and inferior laminae and the medial aspect of the ipsilateral facet joint were reduced, and the ligamentum flavum was removed. When the dural sac and ipsilateral recess were sufficiently decompressed, the medial portions of the laminae were undercut to allow contralateral decompression. By slightly turning the operating table and angling the microscope, a cross-over pathway—which ran dorsally over the dural sac—could be visualized, and as much ligamentum flavum and hypertrophic bone as possible was removed from the contralateral side.

During either procedure, a high- or low-vacuum drain was inserted in most cases. Dural tears (a possible complication of either technique) were repaired using Ti-Cron sutures or closed using TachoSil (Nycomed). Early full mobilization without a brace was encouraged. When dural tears did occur, a few days of postoperative bed rest was prescribed in most cases.
Baseline and Outcome Assessments

Patient Characteristics

Demographic data and preoperative symptoms, as well as some health issues that are correlated with surgical outcomes, were obtained for descriptive purposes and to ascertain homogeneity at baseline. General health status was assessed using Short Form Health Survey-20 (SF-20), which provides scores ranging from 0 to 100. In this study, the scores for pain were reversed so that for all domains higher scores corresponded to improved functioning for the specific domains at that moment.

Primary Outcome Measurements

Bodily pain, such as leg and back pain, was measured using the visual analog scale (VAS) while standing and walking. Functional disability was assessed using the Roland-Morris Disability Questionnaire (RMDQ), which consists of 24 physical limitations related to back pain (a score of 24 indicates severe physical disability), and the Oswestry Disability Index (ODI), which quantifies disability due to back problems (a score of 81–100 indicates being completely bedridden or patients heavily exaggerating their symptoms).

In addition to RMDQ and ODI, we evaluated the effect of surgery on symptoms by asking patients to what degree the leg and back symptoms, in general, were reduced after surgery using a 5-point Likert scale (symptoms were much reduced [scored as 1] through symptoms were much worse [scored as 5]). Symptoms that were much or somewhat reduced were considered clinically relevant and, in this study, referred to as a “marked reduction in symptoms.” Moreover, patients were asked about their main types of symptoms before surgery (i.e., pain, numbness, tingling, lower-limb weakness, heaviness of the lower limbs, and other symptoms, specified further). The patient’s general evaluation of treatment was assessed using a 7-point Likert scale, where answers varied from “I am fully recovered” (1) to “It is worse than ever” (7). Responses such as “complete” or “somewhat recovered” after surgery were considered good results and a surgical success.

Secondary Outcomes

Another important patient-reported outcome measurement was patient satisfaction, assessed using the 5-point Likert scale, where success was scored from “very successful, it helped completely” to “worse than before surgery.” Patients were also asked if they would recommend the surgery to a friend with the same condition. Patients who reported that it was very successful or fairly successful and those who would recommend the procedure to a friend were classified as “overall satisfied.”

Surgical and radiological data included the level that was operated on, length of surgery (from incision until closing), length of hospitalization, both intraoperative and postoperative complications (through 30 days after surgery), the radiological level of stenosis, the presence of degenerative spondylolisthesis (specified by level and grade), and the American Society of Anesthesiologists (ASA) grade.

Statistical Analysis

Sixty-three patients had to be included in each group in order to obtain sufficient statistical power and detect at least a 20% difference in postoperative pain scores (VAS) between surgical techniques (two-sided α = 0.05; power = 80%). Based on our experiences, we expected a 65% response rate to the questionnaires, and therefore aimed to include a minimum of 193 patients.

Statistical analyses were performed using SPSS version 18.0 (SPSS Inc.). The means and standard deviations (continuous variables) and percentages (categorical variables) were calculated for both groups. Differences between treatment groups were analyzed using the unpaired Student t-test for continuous variables, or the chi-square test and Mann-Whitney test for categorical and nonparametric data. All values are presented as the mean ± SD, unless otherwise stated. When significant differences between primary outcomes occurred, regression models were used to describe the possible correlations with confounding factors. Linear regression was used to assess continuous variables (VAS, ODI, and RMDQ), and logistic regression was used to assess dichotomized variables (e.g., patient satisfaction, general patient evaluation, and symptom reduction). Confounding factors with a significance level < 0.010 in the univariate analysis were analyzed using forward stepwise multivariate regression model based on their contributions to the differences in the likelihood ratios.

Results

Patient Selection

Of the 983 patients evaluated for study eligibility, 235 met the inclusion criteria and received a questionnaire. Figure 1 describes the inclusion trajectory that, in the end, resulted in the inclusion of 68 patients in the bilateral group and 107 patients in the unilateral group, thereby exceeding the required calculated sample size.

Baseline Characteristics

The mean age of the study population (n = 175) at surgery was 68 ± 10 years with a mean follow up of 14.2 ± 6.4 months (range 3.3–27.4 months). Table 1 shows no demographic differences between the study groups, and the population was homogeneous in terms of the measured parameters, except for some SF-20 domains. Compared with the mean values of a large Dutch sample comprising patients between 65 and 69 years of age who were selected from the general population (n = 1090), the current study population scored significantly lower on all SF-20 domains, thus indicating poorer general well-being (data not shown). Furthermore, there were no major differences in preoperative symptoms or comorbidities between groups.

Intraoperative Data and Surgical Morbidity

The mean surgical duration was significantly longer for bilaterally operated patients—53 minutes (range 14–126 minutes) versus 42 minutes (range 20–70 minutes) (p < 0.001)—but patients in the unilateral group required longer hospitalizations on average (Table 2).

There were 14 procedure-related complications in 13 patients: 6 durotymes (3.4%), 4 extradural hematomas (2.3%), and 2 wound infections (1.1%), and 1 patient had a dural tear and a postoperative extradural hematoma.
In most cases, dural tears led to obligatory bed rest and subsequently longer hospitalizations. All 5 symptomatic and MRI-confirmed extradural hematomas occurred in the bilateral group, 2 patients required reoperation, and 3 patients were successfully treated conservatively (Table 2). There were no perioperative deaths.

**Primary Outcome Evaluation**

The majority of patients (74.8%) reported reduced back complaints; 58.9% of the patients noted much symptom reduction, 16% at least some reduction, and 25.2% reported poor results (i.e., no change in symptoms or symptoms became somewhat worse or much worse). With respect to leg symptoms, 80.6% of the patients reported marked reduction (64.7% experienced much symptom reduction, and 15.9% reported some reduction). Both the bilateral and unilateral group showed a marked reduction in leg symptoms (not further specified); however, symptom reduction was more significant in the unilateral group than in the bilateral group (85.4% and 73.1%, respectively; p = 0.048) (Table 3). Of note, missing data (1.1%) and patients who reported the absence of leg symptoms (n = 10, 5.7%) preoperatively, and therefore also did not report any symptoms postoperatively, were excluded from this analysis of the effects of surgery.

The overall postoperative ODI and RMDQ scores were low, indicating low levels of disability. In terms of the postoperative pain experienced by patients, the most common complaint was back pain while standing, followed by leg pain while walking. Although there seemed to be a trend toward better scores in the bilateral group, these differences with regard to ODI, RMDQ, and overall pain scores are limited and not statistically significant (p = 0.453, 0.330, and 0.338, respectively) (Table 3). There was also no statistically significant difference between groups in terms of the patients’ general treatment evaluations (p = 0.226).

**Patient Satisfaction**

Most patients considered the procedure to be very successful or fairly successful, and would also recommend their procedure to a friend (data not shown). In general, patients in the unilateral group were more satisfied than patients in the bilateral group (81.9% vs 70.6%, p = 0.082). Moreover, a higher percentage of patients in the unilateral group would give a positive recommendation (91.3% vs 80.6%, p = 0.043). After combining these 2 patient-reported outcome measures, the unilateral approach is considered significantly superior to the bilateral approach (82.1% vs 69.1%, p = 0.047) (Table 4).

**Discussion**

Both the bilateral interlaminar approach for bilateral decompression, as well as the unilateral approach, have been extensively researched and have shown promising results. Most of these studies, however, were limited by the size of the study population and choice of intervention. In many instances, only the unilateral approach was investigated, mainly because it was the only procedure (besides standard laminectomy) performed at the clinic (surgeon...
## TABLE 1. Baseline characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bilateral Group</th>
<th>Unilateral Group</th>
<th>p Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>68</td>
<td>107</td>
<td></td>
</tr>
<tr>
<td>Mean follow-up period (mos ± SD)</td>
<td>14.9 ± 6.6</td>
<td>13.8 ± 6.3</td>
<td>0.297</td>
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<tr>
<td>Mean age at surgery (yrs ± SD)</td>
<td>68 ± 9</td>
<td>66 ± 11</td>
<td>0.250</td>
</tr>
<tr>
<td>Mean age at completing questionnaire (yrs ± SD)</td>
<td>69 ± 9</td>
<td>67 ± 11</td>
<td>0.224</td>
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<tr>
<td>Male sex (%)</td>
<td>45.6</td>
<td>46.7</td>
<td>0.883</td>
</tr>
<tr>
<td>Married</td>
<td>70.6</td>
<td>70.5</td>
<td>0.764</td>
</tr>
<tr>
<td>Living alone</td>
<td>19.4</td>
<td>21.9</td>
<td>0.694</td>
</tr>
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<td>Low</td>
<td>68.7</td>
<td>69.5</td>
<td>0.952</td>
</tr>
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<td>Medium</td>
<td>17.9</td>
<td>16.2</td>
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</tr>
<tr>
<td>High</td>
<td>13.4</td>
<td>14.3</td>
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</tr>
<tr>
<td>Employed ≥32 hrs/wk</td>
<td>11.9</td>
<td>11.8</td>
<td></td>
</tr>
<tr>
<td>Employed &lt;32 hrs/wk</td>
<td>7.5</td>
<td>9.8</td>
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</tr>
<tr>
<td>Unemployed</td>
<td>4.5</td>
<td>11.8</td>
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<tr>
<td>Unfit for work</td>
<td>4.5</td>
<td>7.8</td>
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</tr>
<tr>
<td>Retired</td>
<td>71.6</td>
<td>58.8</td>
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<tr>
<td>Back symptoms present (%)</td>
<td>84.8</td>
<td>87.9</td>
<td>0.572</td>
</tr>
<tr>
<td>Symptoms present ≥12 mos (%)</td>
<td>60.6</td>
<td>68.2</td>
<td>0.593</td>
</tr>
<tr>
<td>Leg symptoms present (%)</td>
<td>95.6</td>
<td>91.3</td>
<td>0.286</td>
</tr>
<tr>
<td>Symptoms present ≥12 mos (%)</td>
<td>60.3</td>
<td>60.6</td>
<td>0.517</td>
</tr>
<tr>
<td>Bilateral symptoms</td>
<td>45.6</td>
<td>31.1</td>
<td>0.128</td>
</tr>
<tr>
<td>Left leg &gt; right leg</td>
<td>29.4</td>
<td>41.7</td>
<td></td>
</tr>
<tr>
<td>Right leg &gt; left leg</td>
<td>25.0</td>
<td>27.2</td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>79.4</td>
<td>81.3</td>
<td>0.757</td>
</tr>
<tr>
<td>Numbness</td>
<td>47.1</td>
<td>52.3</td>
<td>0.496</td>
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<td>Tingling</td>
<td>38.2</td>
<td>35.5</td>
<td>0.716</td>
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<td>Weakness of lower limbs</td>
<td>33.8</td>
<td>38.3</td>
<td>0.547</td>
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<tr>
<td>Heaviness of lower limbs</td>
<td>27.9</td>
<td>24.3</td>
<td>0.591</td>
</tr>
<tr>
<td>Other‡</td>
<td>26.5</td>
<td>18.7</td>
<td>0.224</td>
</tr>
<tr>
<td>Trouble walking due to cardiovascular or musculoskeletal disease (%)</td>
<td>29.9</td>
<td>34.6</td>
<td>0.518</td>
</tr>
<tr>
<td>Operated musculoskeletal apparatus (%)</td>
<td>37.3</td>
<td>43.0</td>
<td>0.458</td>
</tr>
<tr>
<td>Current smoker (%)</td>
<td>16.4</td>
<td>18.7</td>
<td>0.703</td>
</tr>
<tr>
<td>Physical functioning</td>
<td>51.5 ± 35.0</td>
<td>42.7 ± 32.1</td>
<td>0.090</td>
</tr>
<tr>
<td>Role functioning</td>
<td>66.4 ± 45.6</td>
<td>49.5 ± 47.3</td>
<td>0.021</td>
</tr>
<tr>
<td>Social functioning</td>
<td>78.2 ± 27.4</td>
<td>68.0 ± 30.1</td>
<td>0.026</td>
</tr>
<tr>
<td>Mental health</td>
<td>79.5 ± 15.5</td>
<td>70.6 ± 18.6</td>
<td>0.001</td>
</tr>
<tr>
<td>Current health perceptions</td>
<td>64.1 ± 28.3</td>
<td>54.9 ± 26.3</td>
<td>0.032</td>
</tr>
<tr>
<td>Pain§</td>
<td>54.5 ± 31.7</td>
<td>48.1 ± 32.4</td>
<td>0.205</td>
</tr>
</tbody>
</table>

(continued)
bias) or it was given more attention since it is theoretically considered a less invasive technique, given that only a 1-sided interlaminar opening is created. In this retrospective study, we compared the currently available and frequently used minimally invasive techniques in 175 patients with single-level DLSS and evaluated if these techniques demonstrate equal outcomes in terms of postoperative pain, functional disability, symptom reduction, patient satisfaction, and certain surgical parameters.

Primary Outcome Assessments

On average, both treatment groups scored low on the functional disability and pain scales at 14 months after surgery, and more than 70% of the patients reported marked reduction in back and leg symptoms. These results are in accordance with various studies reporting improvement in functional disability and pain after surgery for DLSS.5,6,11,14,38,41,49,51 There were no significant differences in disability (ODI, RMDQ) or leg and back pain (VAS) between treatment groups. However, somewhat surprisingly,
a significant difference was found in the percentage of patients who claimed a marked reduction in leg symptoms (e.g., pain, sensory disturbances, heavy legs, paresthesias). This is contrary to the findings of Thomé et al. who, in a prospective study that compared laminectomy, unilateral, and bilateral laminotomy, found less postoperative leg pain in the bilateral group in comparison with the unilateral group.58 More recently, Hong et al.22 also focused on single-level decompression and reported almost similar results to those in our studies, including no significant differences in the pain scores for the back and leg after a mean follow-up period of 49.3 months. The differences in leg pain that we detected were not related to the surgical procedure or any other clinical parameter included in the multivariate analysis.

Our results do not support the presumption that more back pain will develop in patients who undergo the bilateral approach due to the more extensive bilateral stripping of the spinal muscles, as suggested by several authors.3,24,33,54 The present study also does not support the somewhat unexpected results reported by Thomé et al., that patients who undergo unilateral surgeries develop more back pain.58 In our study, both groups reported marked reduction in back symptoms, and there were no significant differences between groups.

### Patient Satisfaction and General Evaluations

Both techniques showed very good results on important patient-reported outcome measures, with high patient satisfaction rates, and 72.1% and 80.0% of patients in the bilateral and unilateral groups reporting good recovery after surgery, respectively (Table 3). These numbers are higher than the success rates for laminectomy, which vary in the current literature between 50% and 70%12,24,33,47,50,55,58,60 with satisfaction rates between 55% and 73%,6,7,29,58,63 but are similar to the results of unilateral laminotomy studies (successful results in more than 80% of patients, and satisfaction rates ranging from 74.4% to 97%40,55,58,62 and bilateral series (good results reported in 68% to 90% of cases).4,34,52,75,90,64 Interestingly, we did find a difference in patient satisfaction, as significantly more patients in the unilateral group were satisfied overall in comparison with the bilaterally operated patients (82.1% vs 69.1%, p = 0.047). This is in contrast to results reported by Thomé et al. who investigated almost identical techniques (except they also preserved the supra- and interspinous ligaments while using the bilateral technique). In their study, the bilateral approach was found to be preferable to the unilateral technique in terms of overall success (80% vs 70%) and patient satisfaction (97.3% vs 74.4%).58 Again, we did not identify any parameter in the multivariate analysis that explains this difference. Presumably other external factors (e.g., the surgeon or hospital) play more important roles in the patient’s perception of the whole procedure and degree of satisfaction.

### Table 3. Primary outcomes: functional disability and pain

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bilateral Group (n = 68)</th>
<th>Unilateral Group (n = 107)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ODI*</td>
<td>20.3 ± 18.5</td>
<td>22.6 ± 20.4</td>
<td>0.453</td>
</tr>
<tr>
<td>Mean RMDQ†</td>
<td>3.99 ± 5.23</td>
<td>4.80 ± 5.51</td>
<td>0.330</td>
</tr>
<tr>
<td>Mean VAS‡</td>
<td>21.9 ± 24.7</td>
<td>25.6 ± 24.8</td>
<td>0.338</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAS back while walking</td>
<td>21.3 ± 26.7</td>
<td>25.4 ± 27.5</td>
<td>0.327</td>
</tr>
<tr>
<td>VAS back while standing</td>
<td>21.7 ± 28.1</td>
<td>27.9 ± 28.8</td>
<td>0.165</td>
</tr>
<tr>
<td>VAS legs while walking</td>
<td>22.8 ± 28.7</td>
<td>26.2 ± 28.2</td>
<td>0.447</td>
</tr>
<tr>
<td>VAS legs while standing</td>
<td>21.7 ± 28.6</td>
<td>23.3 ± 26.2</td>
<td>0.692</td>
</tr>
<tr>
<td>Effect of surgery on symptoms§</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marked reduced back symptoms (%)</td>
<td>74.6</td>
<td>75.0</td>
<td>0.955</td>
</tr>
<tr>
<td>Marked reduced leg symptoms (%)</td>
<td>73.1</td>
<td>85.4</td>
<td>0.048</td>
</tr>
<tr>
<td>General patient evaluation (%)**</td>
<td></td>
<td></td>
<td>0.226</td>
</tr>
<tr>
<td>Good result</td>
<td>72.1</td>
<td>80.0</td>
<td></td>
</tr>
<tr>
<td>Poor result</td>
<td>27.9</td>
<td>20.0</td>
<td></td>
</tr>
</tbody>
</table>

* Range ODI: 0–100; higher score corresponds with more disability.
† Range RMDQ: 0-24; higher score corresponds with more disability.
‡ Range VAS: 0–100; higher score indicates more pain.
§ Reduced symptoms: symptoms were much reduced or somewhat reduced after surgery.
** Good results: fully, almost completely, or somewhat recovered.

### Table 4. Secondary outcomes: patient satisfaction, general evaluations, and symptom reduction

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Bilateral Group (n = 68)</th>
<th>Unilateral Group (n = 106)</th>
<th>p Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfied w/ surgery (%)†</td>
<td>70.6</td>
<td>81.9</td>
<td>0.082</td>
</tr>
<tr>
<td>Would recommend it to a friend (%)</td>
<td>80.6</td>
<td>91.3</td>
<td>0.043</td>
</tr>
<tr>
<td>Overall satisfied (%)‡</td>
<td>69.1</td>
<td>82.1</td>
<td>0.047</td>
</tr>
</tbody>
</table>

* Values in boldface are statistically significant.
† Surgery was very successful: it helped completely or was considered fairly successful.
‡ Surgery was very successful or fairly successful, and those who provided a positive recommendation to a friend.
Surgical Parameters

The surgical duration has been reported to range from 75 to 119 minutes for unilateral laminotomy,14,22,26,43,55,58 to 90 to 117 minutes for bilateral laminotomy.22,43,55 In most of these publications, multilevel decompression was also performed, which can explain the high averages in comparison with our findings. Hong et al. only addressed single-level L4–5 stenosis and reported an average operating time of 63 minutes for the unilateral approach versus 103 minutes for the bilateral laminotomy.22

It has been suggested that due to the limited visual field available while performing unilateral laminotomy and contralateral decompression, the chance of iatrogenic dural tears is relatively high and the contralateral side is more prone to symptomatic residual stenosis.11,22,46 Surprisingly, and in contrast with other studies,14,34,49,58 we found that dural tears and postoperative hematomas occurred more often in the bilateral group. Applying logistic regression analysis, no surgeon- or patient-related factors significantly accounted for these differences. Furthermore, our clinical findings do not indicate a higher chance of symptomatic residual stenosis in the patients who received unilateral laminotomy. In fact, there was an even higher percentage of patients in the unilateral group who reported marked reduction, and therefore we carefully conclude that if there was any residual stenosis, it did not result in a worse clinical outcome. Moreover, we argue that our results support the claim that using the unilateral approach to treat bilateral decompression is as safe and effective as the bilateral approach.

Study Limitations

The retrospective design of this study yields some limitations—especially missing preoperative VAS, ODI, and RMDQ scores—which make it impossible to adequately compare postoperative status and baseline. Furthermore, this design cannot properly interpret confounding factors and adjust for outcomes. By performing these procedures at different clinics instead of running a randomized controlled trial, surgeon- and hospital-related bias cannot be excluded and might even explain the differences in patient satisfaction.

Some of these limitations would have been avoided if the data on the operated patients had been collected from a national registry. Therefore, we strongly support the efforts already made by the Dutch Spine Society to introduce such a registry in the Netherlands. In our opinion, evaluating the safety and efficacy of different (or new) procedures could benefit from such a registry.

Conclusions

Despite some important limitations, this study of 175 patients provides a good comparison of the unilateral and bilateral interlaminar approaches, with the goal of achieving bilateral decompression in a common clinical setting. We found that both surgical techniques are safe and effective treatment options for single-level DLSS, demonstrating satisfactory postoperative results in terms of functional disability, pain, and patient satisfaction. Based on our findings, no strong recommendations for either the bilateral or unilateral approach can be made. The marked reduction in leg symptoms and overall patient satisfaction significantly favor using the unilateral approach for reasons that cannot be directly explained by the type of surgery or other parameters measured in this study. Patient satisfaction can be influenced by numerous factors, most of them external. To better understand the differences between the two treatment groups in terms of patient satisfaction and clinically notable reduction in leg symptoms after surgery, a randomized trial should be used to prevent a surgeon- and hospital-related bias. Although a randomized controlled trial would provide a higher level of evidence than the current design, we strongly doubt such a trial would be of clinical significance and profitable, because our results show very satisfactory and almost comparable results between the study groups in terms of important primary patient-related outcomes in a common surgical practice.

Key Points

• The overall results were satisfactory. Both surgical techniques have proven to be safe and effective, with short operating times, short hospital stays, and only a few complications.
• There was no difference in functional disability (ODI and RMDQ) or pain (VAS) between the two treatment groups. Leg and back symptoms were reduced in 80% and 75% of all the unilaterally and bilaterally treated patients, respectively.
• Significantly more patients who were treated using the unilateral approach were overall satisfied and demonstrated markedly reduced leg symptoms (not further specified) after surgery. The multivariate analysis showed no relationship between the surgical procedure and any other clinical parameter. Presumably, other external factors (e.g., surgeon or hospital) play more important roles in the patient’s perception of the whole procedure and degree of satisfaction.
• Based on the results of this study—which are very satisfactory in both treatment groups—we strongly doubt if a future “costly” randomized controlled trial would yield added value to our retrospective results.

References

Bilateral vs unilateral interlaminar approach for lumbar stenosis


Author Contributions
Conception and design: all authors. Acquisition of data: den Boogert. Analysis and interpretation of data: all authors. Drafting the article: den Boogert. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Kuijlen. Statistical analysis: den Boogert, Keers. Study supervision: Kuijlen, Keers, Oterdoom.

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