The Influence of Preoperative Back Pain on the Outcome of Lumbar Decompression Surgery

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Study Design. Prospective study with 12-month follow-up.

Objective. To examine how the relative severity of low back pain (LBP) to leg/buttock pain (LP) influences the outcome of decompression surgery for spinal stenosis.

Summary of Background Data. Decompression surgery is a common treatment for lumbar spinal canal stenosis, with generally good outcome. However, concomitant LBP at presentation can make it difficult to decide whether decompression alone will result in a good overall outcome.

Methods. The Spine Society of Europe Spine Tango system was used to acquire the data from 221 patients. Inclusion criteria were lumbar degenerative spinal stenosis, first-time surgery, maximum 3 affected levels, and decompression as the only procedure. Before and 12 months after surgery, patients completed the multidimensional Core Outcome Measures Index (COMI); includes 0–10 LP and LBP scales); at 12 months, global outcome was rated on a Likert-scale and dichotomized into “good” and “poor” groups.

Results. There was a low but significant positive correlation between baseline LP-minus-LBP scores and both improvement in the multidimensional COMI score after 12 months (r = 0.21, P = 0.003) and the score on the 12-month global outcome scale (r = 0.19, P = 0.007). In the good outcome group, mean baseline LP was 2.3 (±3.7) points higher than LBP; in the poor group, the corresponding value was 0.8 (±3.4) (P = 0.01 between groups). In multivariate regression analyses (controlling for age, gender, comorbidity), baseline LBP intensity was the most significant predictor of the 12-month COMI score, and decompressive LP-minus-LBP score of the global outcome (each P < 0.05).

Conclusion. Overall, greater back pain relative to LP at baseline was associated with a significantly worse outcome after decompression. This finding seems intuitive, but has rarely been quantified in the many predictor studies conducted to date. Consideration of relative LP and LP scores may assist in clinical decision-making and in establishing realistic patient expectations.

Key words: spinal stenosis, decompression surgery, registry, back pain, leg/buttock pain. Spine 2009;34:1198–1203

Decompression surgery in the lumbar spine is one of the most common procedures for spinal canal stenosis. Outcomes are generally good, but there is certainly room for improvement. With an increasing number of elderly patients seeking an active lifestyle, and limitations in the conservative management of the disease, surgery is becoming more widely accepted. Many studies have looked at independent predictors of surgical outcome such as age, comorbidity, smoking, etc., but meta-analyses of these studies reveal that few factors stand out as powerful predictors. Surprisingly, the main symptoms of the patient—leg pain (LP) and low back pain (LBP)—and the relationship between the two have not been analyzed in relation to their potential role in predicting outcome. In stenosis patients with predominantly LP and claudication symptoms, surgical decision-making is usually straightforward. However, in this typically elderly population of patients, the degree of concomitant LBP can also be appreciable. This may be due to wider-spread degenerative changes in the lumbar spine or can be part of the stenosis itself. The influence of decompression alone on LBP is uncertain, making it at times difficult to decide which patients should be treated with decompression alone, and which might perhaps benefit from additional fusion type surgery. Disregarding the amount of LBP has the potential to lead to false expectations of treatment and lower patient satisfaction, should these symptoms persist after surgery despite adequate decompression.

Materials and Methods

Inclusion Criteria

The study was carried out within the framework of the Spine Society of Europe Spine Tango Spine Surgery Registry. It included the data of all patients undergoing surgery in the Spine Center of a specialized orthopaedic hospital (February 2004–March 2007) that were fluent in either German or English, had a minimum 1-year follow-up, and satisfied the surgical admission criteria. The latter were as follows: no previous surgery at the same level; degenerative spinal stenosis of the lumbar spine with or without any additional pathology other than disc herniation; maximum 3 segments/vertebral bodies affected; and undergoing surgical decompression with no additional fusion or stabilization. Spinal stenosis itself was diagnosed based on the surgeon’s own clinical impression from the clinical history and appropriate radiologic imaging (i.e., the normal clinical work-up, as per their everyday practice).

Decompression was mostly achieved through partial facet joint resection, flavectomy, laminotomy, and foraminotomy; the use of total laminectomy is now very rare in our institution (Table 1).
Table 1. Patients' Demographic and Baseline Self-Rated Clinical Data, and Operative Procedures (Means ± SD, or % Values)

<table>
<thead>
<tr>
<th>Variable</th>
<th>72.4 ± 9.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>109 women (51%)</td>
</tr>
<tr>
<td>Gender</td>
<td>112 men (49%)</td>
</tr>
<tr>
<td>Comorbidity, ASA score (%)</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>9.5</td>
</tr>
<tr>
<td>II</td>
<td>42.3</td>
</tr>
<tr>
<td>III</td>
<td>46.8</td>
</tr>
<tr>
<td>IV</td>
<td>1.4</td>
</tr>
<tr>
<td>Baseline leg pain intensity (0–10 scale)</td>
<td>6.5 ± 2.6</td>
</tr>
<tr>
<td>Baseline back pain intensity (0–10 scale)</td>
<td>4.6 ± 3.1</td>
</tr>
<tr>
<td>Leg pain minus back pain (–10 to 10)</td>
<td>1.9 ± 3.7</td>
</tr>
<tr>
<td>Baseline multidimensional COMI score</td>
<td>7.3 ± 1.9</td>
</tr>
<tr>
<td>(0–10 scale)</td>
<td></td>
</tr>
<tr>
<td>Main problem (patient-rated) (%)</td>
<td></td>
</tr>
<tr>
<td>Back pain</td>
<td>19.7</td>
</tr>
<tr>
<td>Leg pain</td>
<td>48.8</td>
</tr>
<tr>
<td>Sensory disturbances</td>
<td>30.1</td>
</tr>
<tr>
<td>None of the above</td>
<td>1.4</td>
</tr>
<tr>
<td>Types of decompression used* (% cases)</td>
<td></td>
</tr>
<tr>
<td>Partial facet joint resection</td>
<td>72.9</td>
</tr>
<tr>
<td>flavectomy</td>
<td>67.4</td>
</tr>
<tr>
<td>laminotomy</td>
<td>67.0</td>
</tr>
<tr>
<td>Foraminotomy</td>
<td>56.1</td>
</tr>
<tr>
<td>Hemilaminectomy</td>
<td>21.7</td>
</tr>
<tr>
<td>Laminectomy</td>
<td>8.1</td>
</tr>
<tr>
<td>Discotomy</td>
<td>3.2</td>
</tr>
<tr>
<td>Other</td>
<td>1.4</td>
</tr>
</tbody>
</table>

*Do not add up to 100%, since multiple procedures are used in a given patient.

Statistical Analyses

Descriptive data are presented as means ± standard deviations (SD). For each patient, the LP-LBP score difference was determined.

Linear regression analyses were used to examine the relationship between the preoperative LP-LBP scores and (1) the change in COMI score (from presurgery to 12-month postsurgery) (2) the global outcome category at 12 months. The significance of the difference between the good and poor outcome groups for their preoperative LP-LBP scores was analyzed using an unpaired Student t test. This gave a first approximation as to whether the LP-LBP score might be associated with outcome.

The association between the "main problem" and "global outcome" (dichotomized as good and poor) was analyzed using contingency analyses/χ² test, and the change in COMI score for each of the "main problems" (back, leg, sensory) was examined using a 1-way analysis of variance, with a post hoc Fisher PLSD test being used to locate the significance of any differences.

Multivariate longitudinal regression analysis was used to predict the 12-month postoperative COMI score after decompression surgery. The baseline COMI score, age, gender, and comorbidity were first entered (as control variables, since they are recognized potential confounders in analyses of such patients), followed by preoperative LP, LBP, and LP-LBP scores (as potential predictors, using forward conditional selection). Multivariate logistic regression analysis was used to predict the 12-month outcome category (good or poor, based on the dichotomization described earlier). Again, age, gender, and comorbidity were first entered (as control variables, followed by preoperative LP, LBP, and LP-LBP scores (as potential predictors, using forward conditional selection). Statistical significance was accepted at the P < 0.05 level.

Results

For the registry in general, within our Spine Center, the compliance rate for the surgeons' completion of the Surgical Forms was 87%; 91% of patients who were sent a 12-month follow-up questionnaire returned it complete.

Of the 3067 patients in the database (operated between February 04 and March 07) with 12-month follow-up, 221 patients satisfied the surgical admission criteria. Their baseline data are shown in Table 1.

Global Outcomes

At the 12-month follow-up, the patient-rated global outcomes were as follows: 94 of 221 (42.5%) operation helped a lot; 73 of 221 (33.0%) operation helped; 27 of 221 (12.2%) operation helped only little; 22 of 221 (10.0%) operation did not help; and 5 of 221 (2.3%) operation made things worse. Hence, 167 of 221 (75.6%) patients had a good outcome, and 54 of 221 (24.4%) had a poor outcome.

Baseline Leg Pain and Back Pain in Relation to Outcome

There was a low but nonetheless significant correlation between the preoperative LP-LBP score and the change in COMI score from presurgery to 12-month postsurgery, i.e., the more that LP predominated at baseline in relation to back pain, the greater the improvement in the multidimensional COMI score at 12-month follow-up.
The mean ± SD reductions in COMI score after 12 months for the main problem groups were 2.4 ± 3.0 for back pain, 4.2 ± 2.9 for “LP,” and 3.4 ± 2.9 for “sensory disturbances.” Only the back and leg groups differed significantly from each other (P = 0.0007). The corresponding values for the reduction in back pain (0–10 scale) were 2.5 ± 3.2 for the “main problem, back pain” group, 1.4 ± 3.2 for LP, and 2.3 ± 3.0 for sensory disturbances. The difference between the back and leg groups just failed to reach significance (P = 0.054). The reduction in LP (0–10 scale) was 0.8 ± 3.7 for the main problem back pain group, 4.5 ± 3.2 for LP, and 4.0 ± 3.1 for sensory disturbances. The back group differed significantly from both the leg group (P < 0.001) and sensory disturbance group (P < 0.001).

In multiple regression analysis (after controlling for age, gender, comorbidity, and baseline COMI-score), baseline LBP scores were the most significant unique predictor of the 12-month COMI score (P < 0.0001) (Table 2). The positive beta coefficient of 0.3 for the LBP score indicates that for each 1-point increase in LBP intensity at baseline there is a 0.3-point increase in the 12-month COMI score (i.e., a worse outcome). Male gender and lower comorbidity were also significantly associated with a lower COMI score (better outcome) at 12 months. The multivariate model explained 19% variance in outcome (Table 2).

In multiple logistic regression analysis (after controlling for age, gender, and comorbidity), preoperative LP-LBP scores were the most significant predictor of the 12-month outcome score (Table 3). The odds ratio of 1.119 indicates that the odds of a good outcome are
increased by approximately 12% for each unit increase in baseline LP-LBP.

**Discussion**

The main finding of the present study was that in patients with lumbar spinal stenosis undergoing decompression surgery, a higher LP relative to LBP, before surgery, was associated with a significantly better 12-month outcome. The negative influence of LBP was evident in terms of both the global outcome (a retrospective rating of the patient’s perceived success of the procedure) and the prospectively measured changes in the multidimensional patient-orientated COMI score. This finding seems intuitive, but has not been quantified in the many predictor studies conducted to date. Spratt et al. and Aalto et al. examined various predictors of outcome of decompression surgery, such as smoking, age, and pain, but they did not differentiate between the location of pain or examine the relative predominance of leg versus back pain. Katz et al. did examine the extent of back versus LP, but they did not seem to quantify it, e.g., on a pain-scale, and did not identify it as a predictor of outcome; instead, they found that global health and comorbidity were the most powerful predictors of outcome. Jonsson and Strömqvist showed that a patient group with no history of LBP reported more favorable results concerning sciatica at follow-up compared with those with a history of LBP, while Atlas et al. showed that having baseline back pain greater than LP was associated with worse outcomes when the results of patients treated surgically or nonoperatively were combined. However, in each of these studies, the actual difference in region-specific pain scores was not quantified.

Fokter and Erby assessed outcome using the Zwick-Ludwig Claudication Questionnaire, which does enquire separately about back pain and LP in its symptom severity section, but in their predictive model they did not include any quantitative analyses in relation to pain location; further, their treatment was not uniform, as 34% of the patients received fusion in addition to decompression.

Yamashita et al. classified patients based on their LP syndrome and examined whether these classifications were correlated with outcome. However, they only considered preoperative LP in a qualitative way, differentiating between unilateral and bilateral LP and showing that patients with unilateral symptoms had a better outcome as far as LP (but not back pain) was concerned. In the present study, we were unable to differentiate between unilateral and bilateral LP, on account of the necessary brevity of the questionnaire used in the Spine registry system.

Various outcome instruments have been proposed for the assessment of patient-rated outcomes. In the present study, we used a short, reliable, sensitive, multidimensional instrument—the COMI—that was developed and validated extensively in previous studies and was adopted for use within the Spine Tango framework. Assessing the 2 key complaints of the patient separately, and using such an assessment to quantify the differential between LP and back pain, gives a more detailed insight into where the patient sees his biggest problem. The fact that the amount of concomitant LBP is a predictor of outcome after decompression indicates that the underlying cause of LBP should be analyzed more closely because decompression alone does not seem to alleviate the symptoms sufficiently. Thus, any patient scheduled for decompressive lumbar surgery for spinal stenosis should be assessed quantitatively for additional LBP, and in particular the degree of difference between the 2 complaints. This information could be used to guide treatment and better inform the patients about their likely outcome in the presence of LBP.

One of the shortcomings of the present study is the uncertainty regarding the definition of buttck pain and the “location” to which it is best classified as belonging, back or leg. Because the location and quantification of the condition-specific pain is one of the major aspects of this study, a critical look at the problem of assessing buttck pain is warranted. Buttck pain is a common and typical complaint of patients with spinal canal stenosis, though rarely a unique one. The differential diagnosis of buttck pain includes a variety of other causes, such as sacroiliac joint disease, piriformis syndrome, pelvic nerve root entrapment, and certain vascular problems. Thus, it is necessary to rule out these differential diagnoses in the presence of spinal canal stenosis. After this, most clinicians would probably agree that the combination of buttck pain and LP represents the referred pain in spinal canal stenosis, differentiating it from the more mechanical LBP. However, patients often report pain in complex patterns, with overlap between different regions, and it may be hard for the patient to differentiate between back pain and buttck pain, since there is no clear boundary between these anatomic sites. The literature does not offer a clear definition of what constitutes buttck pain and what constitutes back pain, leaving the clinician and the patient to make the final assessment. In the present study, all the analyses were carried out based on the distinction made by the patient him/herself.

Another possible weakness of the study was that we did not differentiate between patients with lateral recess stenosis versus central canal stenosis because these distinctions cannot easily be made within the framework of the Spine Tango assessment. However, since the objective in both underlying diseases is basically the same, namely, the alleviation of leg and buttck pain, we did not feel that this was a major shortcoming.

The present study capitalized on the data collected within a spine surgical registry. Though not without its own drawbacks, data collected in this manner are not biased by the selective participation of certain types of patients, as is sometimes the case in randomized controlled trials, and the results reflect the work of all the surgeons participating within that practice and their potentially varied clinical load, surgical preferences, and
patient types. Such data hence have the potential to assist in deciding whether a change in practice (or further studies on current practice) might be warranted, and assist with decision-making and the informed consent process on an individual basis.

Our study demonstrated a significant negative influence on outcome of a high baseline back pain score relative to LP in patients with spinal stenosis undergoing decompressive surgery. With an R² for the multiple linear regression model of 0.19, the effect size (R²/1-R²; 0.23) is to be considered "medium to large" (where 0.15 is medium, 0.35 large[30]). Nonetheless, the predictive power of both of the multivariate models (predicting either 12-month COMI scores or global outcome) was too low to build a reliable clinical prediction rule. Possibly with greater numbers and the consideration of other potential determinants/confounders it will be possible to develop a more reliable algorithm that will indicate the relative degree of LP and back pain that is associated with a better outcome after decompression surgery. This would assist the spine surgeon in his/her preoperative planning. Future studies should also assess whether the addition of fusion to decompression in patients with notable LBP results in a better overall outcome.

## Conclusion

The degree of concomitant LBP is a significant determinant of the outcome of decompression surgery for spinal stenosis. Quantification of both LP and back pain may assist with clinical decision-making and help in directing patients' expectations regarding the likely outcome of decompression.

## Key Points

- In 221 spinal stenosis patients undergoing decompression, those with a good global outcome after 12 months had (before surgery) a significantly lower degree of back pain relative to LP than those with a poor outcome.
- The greater the LP-minus-LBP score before surgery, the greater the reduction in multidimensional COMI (r = 0.21, P = 0.003), and the better the global outcome rating at 12-month follow-up (r = 0.19, P = 0.007).
- In patients who declared at baseline that their main problem was back pain, 62% had a good global outcome; in those reporting LP, 80% had a good global outcome (P = 0.04).
- In multiple regression analysis controlling for age, gender, and comorbidity, and baseline COMI score, increasing preoperative LBP intensity was associated with a higher 12-month COMI score (i.e., worse outcome) (P < 0.0001).

- In logistic regression analysis controlling for age, gender, and comorbidity, the higher the preoperative LP-minus-LBP intensity score, the better the 12-month global outcome (P < 0.0001).
- Overall, a lower level of preoperative LBP compared with LP resulted in significantly better outcomes after decompression surgery. Consideration of relative LP and LP scores may assist in clinical decision-making and in establishing realistic patient expectations of surgery.

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## References