THE natural course of sciatica due to lumbar disc herniation is good, and thus timing of operative intervention is important. Patients in whom there has been a long duration of leg pain may, however, be at risk of developing chronic pain. Experimental studies on pain mechanisms have shown that central nervous system structures are modifiable and not static in function. These mechanisms, known as central sensitization, however, are short-lived and cannot serve as an explanation of why pain continues when peripheral stimulus has disappeared. Recently researchers have demonstrated more long-term plastic changes in nociceptive transmission in the spinal cord, underscoring that there may be a noxious memory in the dorsal horn. Because these mechanisms probably need time to develop, the time of peripheral stimulation in primary afferent nerve fibers may be of importance for the development of chronic pain.

In a previous retrospective study we have shown that duration of symptoms may be a predictor of patient outcome after surgery for lumbar disc herniation. The aim of the present study was to investigate different aspects of the duration of symptoms as predictors of surgery-related outcome in a prospective cohort study.

Object. The aim of this study was to investigate different variables in the duration of symptoms that can be used to predict outcome after lumbar microdiscectomy.

Methods. In a prospective study of 132 consecutive patients who underwent surgery for lumbar disc herniation, the authors evaluated the prognostic value of different variables in the duration of symptoms for the 1-year period after surgery. The 1-year follow-up investigation was conducted by an independent observer. Assessment of outcome was performed using a clinical overall score (COS), which was recently assessed for its reliability and validity. As for factors predictive of outcome, only duration of leg pain and sick leave reached statistical significance in the multivariate analysis. Results of the univariate analysis demonstrated that in patients experiencing preoperative leg pain fewer than 4 months and between 4 and 8 months, a significantly lower COS at the 1-year follow up was demonstrated compared with those in whom the duration of leg pain was longer (> 8 months). One hundred eight patients returned to work within the 1st year after surgery. Patients who took a sick leave of more than 28 weeks before the operation were at higher risk of not returning to work.

Conclusions. Analysis of these results indicates that leg pain lasting more than 8 months correlates with an unfavorable postoperative outcome in patients with lumbar disc herniation, as well as a high risk of not returning to work.

KEY WORDS • lumbar disc herniation • lumbar discectomy • surgery • outcome • duration of symptoms

Abbreviation used in this paper: COS = clinical overall score.
magnetic resonance images of the lumbar region; and confirmation of the diagnosis of lumbar nerve root compression due to disc herniation at the time of surgery. Exclusion criteria included the following: previous back surgery, percutaneous discectomy, or chymopapain injection; osseous stenosis or other disease of the lumbosacral spine; other neurological disease; an age of more than 60 years; and recurrent disc herniation during the 1-year follow-up period.

Clinical Assessment and Follow Up

To assess the clinical state of the patient, an overall examination as previously described was performed preoperatively and at the 12-month follow-up examination. The examination at 12 months postsurgery was performed by an independent observer and included the measures discussed below.

Pain. Pain intensity was recorded separately by using two 100-mm visual analog scales for back and leg pain, with endpoints being no pain and worst conceivable pain. The highest intensity of the two was used in calculating the overall score.

Clinical Examination. Examination was conducted for 1) spinal deviation in an upright or flexed position; 2) Lasègue’s sign, regarded as positive if straight leg raising elicited clear evidence of nerve root pain in the lower extremity; and 3) neurological deficits (muscle atrophy, muscle strength, and sensory impairment to pinprick).

Functional Status. The functional status was assessed by administering the Oswestry Low Back Pain Disability Questionnaire, which is based on 10 different variables referring to activities of daily living.

Analgesics. The type and dose of analgesic agents were registered. The scoring scale was based on a scheme in which the different pain killers are classified into one of five groups, depending on type, dose, and possible combinations with other drugs.

The results of these different measures were combined to form a COS for each patient. We developed a weighted scale by assigning values to each measure. For example, because pain is the most important symptom in sciatica due to lumbar disc herniation, we assigned a value of four points to the pain-intensity score, whereas each of the other three measures counted for two points. The maximum COS, when adding the four weighted scores, was 1000 points and represented the maximum value of pain and clinical symptoms and signs.

Further, a preoperative questionnaire was used to collect information of different aspects regarding the duration of symptoms.

Surgical Procedure

All surgeries were performed by the same surgeon (Ø.P.N.). A standard microdiscectomy was performed using Caspar self-retaining retractors and an operating microscope.

Statistical Analysis

A multiple linear regression analysis was performed to determine the significance of the relationship between the duration of symptoms and the COS. The following factors were originally included in the model: age, sex, duration of leg pain, duration of back pain, duration of sick leave, time since initial onset of leg pain, and time since initial onset of back pain.

Differences between groups were calculated using one-way analysis of variance. Only when overall significance was identified were differences between pairs of means tested using Fisher’s post-hoc test. The association between the duration of preoperative sick leave and return to work were analyzed using the Mann–Whitney U test. Data are represented as means ± standard deviation. Statistical significance was set at p < 0.05.

Results

Table 1 provides a summary of the association between predictors (independent variables) and the postoperative COS (dependent variable) as determined in the final multiple linear regression analysis. Only duration of leg pain and of sick leave reached levels of statistical significance.

To explore the association between the duration of leg pain and the surgical outcome further, the data obtained on leg pain were divided into four groups (quartiles): duration of leg pain less than 4 months, 4 to 8 months, 8 to 12 months, and greater than 12 months. The univariate analysis demonstrated significant statistical difference among groups of patients (Fig. 1). In patients in whom duration of leg pain was the shortest (< 4 months) a significantly lower COS was demonstrated at the follow-up examination compared with patients in whom duration of leg pain was longer (> 8 months).

One hundred eight patients returned to work within the 1st year after surgery. Figure 2 presents a box plot in which it is shown that in patients who returned to work, a significantly shorter period of sick leave was taken before the operation. The 75th percentile for this latter group of patients is 28 weeks, indicating that patients who took sick leave that lasted over 28 weeks preoperatively are at high risk of not returning to work.

Discussion

The results of this prospective cohort study indicate that duration of preoperative leg pain and sick leave are pre-

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**Table 1**

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Coefficient b</th>
<th>Standard Error</th>
<th>t-test</th>
<th>p Value</th>
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<tr>
<td>sex</td>
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<td>duration of leg pain</td>
<td>0.98 ± 0.30</td>
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<td>duration of back pain</td>
<td>−0.26 ± 0.16</td>
<td>−1.65</td>
<td>0.10</td>
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<tr>
<td>duration of sick leave</td>
<td>1.67 ± 0.56</td>
<td>2.97</td>
<td>0.0037</td>
<td></td>
</tr>
</tbody>
</table>

*Residual standard deviation 128.92; R² = 0.21.
Duration of leg pain as a predictor of outcome

Fig. 1. Bar graph depicting the postoperative COS in patients with variable preoperative durations of leg pain (quartiles). Significant differences are indicated by *p < 0.05.

Fig. 2. Box plot showing the relationship between postoperative status and the preoperative duration of sick leave (sicklisted).

In 1983, Weber reported on a controlled prospective study of 126 patients who were randomized to undergo either surgical or conservative treatment. At the 4-year follow up, a sick leave of more than 3 months' duration was associated with an unsatisfactory result in both groups.

Dvorak, et al., found that in patients in whom symptoms had occurred for fewer than 6 months before surgery, better long-term results were demonstrated. Hurme and Alaranta found better results in patients if the sick-leave period did not exceed 1 month.

It is not surprising that both duration of leg pain and sick leave were found to be predictors of clinical outcome in the multivariate model. These predictors are closely related, and the duration of sick leave, in part, reflects the severity of the leg pain in this period.

Experimental studies in the porcine cauda equina have demonstrated that the duration of compression is critical for recovery after nerve root compression. However, this model only included acute compression of nerve roots. No experimental data are available on the effect of the duration of compression in the chronic, compressed nerve root. The aforementioned and other studies have only investigated nerve function by using electrophysiology, and they have only studied local changes in the nerve root.

The mechanisms of chronic pain are not well understood. It is puzzling that after an episode of acute pain, hyperalgesia and allodynia may persist for years despite perfect tissue healing. The demonstration of plasticity and a nociceptive memory within the dorsal horn in animal models may represent the missing link in the understanding of persistent sciatica despite the absence of postoperative radiologically detectable compression of the nerve root. The time needed to develop these changes in the dorsal horn in humans however, is unknown.

Conclusions

In planning the timing of surgery for lumbar disc herniation, we must consider the natural course of the disease. Surgery is seldom indicated before 6 to 8 weeks of leg pain. Based on our results, the time for surgical treatment of lumbar disc herniation may be ap-
proximately 2 to 8 months. There are weak indications for surgery before 2 months of sustained leg pain, and after 8 months the risk of a less favorable clinical result is probably increased.

References


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