Association of extended duration of sciatic leg pain with worse outcome after lumbar disc herniation surgery: a register study in 6216 patients

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OBJECTIVE Sciatica is the hallmark symptom of a lumbar disc herniation (LDH). Up to 90% of LDH patients recover within 12 weeks regardless of treatment. With continued deteriorating symptoms and low patient quality of life, most surgeons recommend surgical discectomy. However, there is not yet a clear consensus regarding the proper timing of surgery. The aim of this study was to evaluate how the duration of preoperative leg pain (sciatic neuralgia) is associated with patient-reported levels of postoperative leg pain reduction and other patient-reported outcome measures (PROMs) in a prospectively collected data set from a large national cohort.

METHODS All patients aged 18–65 years undergoing a lumbar discectomy during 2013–2016 and registered in Swespine (the Swedish national spine registry) with 1 year of postoperative follow-up data were included in the study (n = 6216). The patients were stratified into 4 groups according to preoperative pain duration: < 3, 3–12, 12–24, or > 24 months. Patient results assessed with the numeric rating scale (NRS) for leg pain (rated from 0 to 10), global assessment of leg pain, EQ-5D, Oswestry Disability Index (ODI), and patient satisfaction with the final surgical outcome were analyzed and compared with preoperative values and between groups.

RESULTS A significant improvement was seen 1 year postoperatively regardless of preoperative pain duration (change in NRS score: mean –4.83, 95% CI –4.73 to –4.93 in the entire cohort). The largest decrease in leg pain NRS score (mean –5.59, 95% CI –5.85 to –5.33) was seen in the operated group with the shortest sciatica duration (< 3 months). The patients with a leg pain duration in excess of 12 months had a significantly higher risk of having unchanged radiating leg pain 1 year postoperatively compared with those with < 12-month leg pain duration at the time of surgery (OR 2.41, 95% CI 1.81–3.21, p < 0.0001).

CONCLUSIONS Patients with the shortest leg pain duration (< 3 months) reported superior outcomes in all measured parameters. More significantly, using a 12-month pain duration as a cutoff, patients who had a lumbar discectomy with a preoperative symptom duration < 12 months experienced a larger reduction in leg pain and were more satisfied with their surgical outcome and perception of postoperative leg pain than those with > 12 months of sciatic leg pain.

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KEYWORDS lumbar disc herniation; sciatica; surgical timing; time to surgery

THE hallmark symptom of a lumbar disc herniation (LDH) is radiating leg pain (sciatic neuralgia). The distribution of radiating leg pain depends on the affected nerve root, and the two lowermost disc levels, L4–5 and L5–S1, are the most commonly affected, accounting for 95% of all surgically treated LDH.¹

In the majority of the patients (70%) presenting with LDH and concomitant sciatica, nonsurgical treatment leads to full restitution in 4 weeks, increasing to 90% of patients within 3 months.^{2,3} With persistent symptoms

despite conservative treatment for at least 3 to 6 months, or with concerning clinical deterioration, most guidelines advocate a surgical approach, which is also supported in a recent meta-analysis.⁴

Earlier studies, including randomized controlled trials (RCTs), have in part investigated the effect of the duration of sciatica before surgery on patient-reported outcome measures (PROMs). Some studies advocate an extended period of conservative treatment based on their findings, whereas other conflicting studies have highlighted less

ABBREVIATIONS GA = global assessment; LDH = lumbar disc herniation; NRS = numeric rating scale; ODI = Oswestry Disability Index; PROM = patient-reported outcome measure; RCT = randomized controlled trial; Swespine = Swedish spine register; VAS = visual analog scale.

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favorable outcomes and an increased number of patients who are unsatisfied after suffering a prolonged preoperative pain duration.^{5–9} However, no clear consensus has yet been established regarding the optimal timing for LDH surgery, or if patients seeking help with an extended pain duration should be advised against having surgery.

The objective of this study was to evaluate the postoperative reduction in leg pain and surgical satisfaction PROMs in relation to the preoperative duration of sciatic leg pain in patients undergoing LDH surgery who were registered as discectomies in the Swedish spine register (Swespine) between 2013 and 2016. The design of this study and report was performed according to the STROBE statement.¹⁰

Methods

Swespine and Collection of Data

This study was a national cohort study using prospectively entered data from Swespine from January 2013 to December 2017. Swespine was started 25 years ago and now includes the majority of all national hospitals and clinics performing spinal surgery in Sweden.¹¹ Approximately 2100 LDH surgeries are registered every year, projected to encompass in excess of 75% of all such procedures in Sweden. Both surgical and demographic data as well as PROMs are registered in Swespine. Data are self-reported by the patient regarding pain duration, pain intensity, and personal satisfaction with the surgical outcome. Study data used were gathered preoperatively and at the 1-year follow-up. Ethical permission was given by the Regional Ethical Review Board in Gothenburg of the Sahlgrenska Academy, Gothenburg University, Gothenburg, Sweden (ID no. 753-17).

Inclusion and Exclusion Criteria

All patients between 18 and 65 years of age with a disc herniation at the lumbar level (L3–S1) treated with disc herniation surgery were included in the study. The inclusion and exclusion criteria were formulated to select those patients with isolated LDH-related complaints as much as possible. The age limits were set to exclude patients with pediatric-type LDH and older patients with severe degenerative diseases such as spinal stenosis. All patients with a concomitant add-on diagnosis to LDH, such as spondylolisthesis, were excluded. Patients who had previous spinal surgery or at the present LDH surgery had a concomitant fusion procedure were not included. Patients with no preoperative radiating leg pain, an unknown duration of sciatica, or insufficient preoperative or follow-up data were also excluded. The inclusion/exclusion process is illustrated in Fig. 1.

Surgical Procedures

All types of modern surgical procedures used for the removal of disc herniation, including conventional mini-open, microscopic, and endoscopic procedures, were used in the patient group and available in the register.^{12–14} These years correspond to the first time full endoscopic lumbar discectomy was available in Sweden, and the data thus comprise results obtained with all commonly available methods of surgical discectomies. However, the vast ma-

FIG. 1. Flowchart depicting initial patient availability and exclusion and inclusion criteria.

jority of surgeries were performed conventionally and microscopically. The different surgical techniques have previously been described and have been demonstrated to be equal in regard to clinical outcomes.¹⁵ Patients undergoing LDH surgery but registered as undergoing decompressions due to cauda equina syndrome or anatomical difficulties were also included if the underlying diagnosis was stated as LDH *without* spinal stenosis or other conditions.

Preoperative Duration of Sciatica

The patients were stratified into 4 groups according to their duration of leg pain prior to surgery, with the intervals < 3, 3–12, 12–24, and > 24 months, as already predetermined within Swespine. These intervals are commonly used in other registers and have also been used in other published work.⁷ The preoperative duration of sciatica was self-reported by the patients and based on the question,

“For how long have you had your sciatica in the leg/legs?” This question had 5 different response options: no sciatica, < 3 months, 3–12 months, 12–24 months, and > 24 months.

Leg Pain and PROMs

All patients included in the analysis had answered a preoperative and a 1-year postoperative follow-up questionnaire as a routine procedure of Swespine. The numeric rating scale (NRS; score 0–10) was used to assess leg pain pre- and postoperatively. Swespine previously used the visual analog scale (VAS; score 0–100) as a measurement for pain, but in January 2016 there was a transition to using the NRS score. All VAS values in our study were converted to NRS scores.

At the 1-year follow-up, a qualitative single-item leg pain question, the global assessment (GA), was additionally included, being phrased as “How do you rate your leg pain today as compared to before you had your back surgery?” The GA question had 6 response options: 0, had no preoperative leg pain; 1, pain free; 2, much better; 3, somewhat better; 4, unchanged; and 5, worse.¹⁶ Patient satisfaction regarding the final surgical result was recorded as the answer to the question, “What is your attitude regarding the final outcome of your surgery?” with 1 of 3 response options: 1, satisfied; 2, uncertain; and 3, dissatisfied. The Swedish versions of the Oswestry Disability Index (ODI) and EQ-5D were used for assessment regarding quality of life.^{17,18}

Statistical Analysis

Statistical analysis was performed with the SAS System version 9.4 (SAS Institute Inc.). Descriptive statistics for patient demographics and outcomes were reported as proportion and count for categorical variables. Continuous variables were reported as mean and standard deviation and median with the first and third quartiles. For comparison between 2 groups, the Fisher nonparametric permutation test was used for continuous variables. The Fisher exact test was used for dichotomous variables, the Mantel-Haenszel chi-square test for ordered categorical variables, the Pearson chi-square test for nonordered categorical variables, and the Jonckheere-Terpstra test for continuous variables.

Adjusted analyses between groups were performed with ANCOVA. Multivariable logistic regression was performed to analyze the association between predictors, and change in the NRS score for leg pain (Δ NRS; leg pain NRS score at 1 year minus leg pain NRS score preoperatively) at the 12-month follow-up was used as a dependent variable. Sex, age, and level of disc herniation were included as independent variables. Finally, for the purpose of trying to find the best predictive model for Δ NRS 12 months after lumbar discectomy, a stepwise multivariable linear model was used. Predictors with $p < 0.20$ were entered into a forward stepwise analysis. Univariable and multivariable logistic regression were used for dichotomous dependent variables. The results of the logistic regression models were presented with odds ratios (ORs), 95% confidence intervals (CIs), and p values for each included variable, and area under the receiver operating characteristic curve was used as a measurement of goodness of fit for the total model. For analyses of change from before surgery to

the 12-month follow-up, a Fisher nonparametric permutation test was used for continuous variables and a sign test for dichotomous and ordered categorical variables.

All significance tests were 2-sided and conducted at the 5% significance level.

Results

Preoperative baseline data of the study population are presented in Table 1. From the total number of 43,556 patients registered in Swespine during 2013–2017, 6216 patients with first-time surgical discectomy and with 1 year of follow-up data were eligible for final analysis in the study (44.3% women and 55.6% men). The majority of the patients (87.5%) were nonsmokers, and the population had a mean BMI of 26.4 kg/m². The L5–S1 surgical level was the most common (52.1%), second to L4–5 (42.0%). All other levels (L3–4 and sacral levels) accounted for 5.9%. Concerning the primary variable—the preoperative duration of radiating leg pain—the majority of the patients (58.1%) had a preoperative duration of sciatica between 3 and 12 months. Durations of radiating leg pain of 3 months and 12–24 months each occurred in 15% of patients. Almost 12% of the patients had a leg pain duration > 2 years.

As a single cohort, the patients rated their back pain prior to surgery as less intense compared to their radiating leg pain. The mean NRS back pain score was 4.94 (95% CI 4.87–5.02), and the mean NRS leg pain score was 7.02 (95% CI 6.96–7.07). The changes in PROMs and pain scores for the entire cohort are presented in Table 2.

Duration of Sciatica and Postoperative Improvement in Leg Pain Rated by the NRS Score

Regardless of preoperative pain duration or intensity, there was an improvement in postoperative radiating leg pain (NRS score) with a decrease in the entire study group to a residual mean NRS leg pain score of 2.16, with a mean decrease of -4.83 (95% CI -4.73 to -4.93 , $p < 0.0001$).

The largest improvement in the NRS leg pain score (mean -5.59 , 95% CI -5.85 to -5.33) was seen in the group with the shortest duration of radiating leg pain (< 3 months), as illustrated in Fig. 2. With a pain duration ranging from 3 to 12 months, the mean improvement was -5.00 (95% CI -5.12 to -4.87). The improvements were slightly less in patients with pain durations of 12–24 months (-4.19 , 95% CI -4.46 to -3.92) and > 24 months (-3.85 , 95% CI -4.15 to -3.55).

When the stratified sciatic leg pain duration groups (< 3, 3–12, 12–24, or > 24 months) were compared with the Fisher nonparametric permutation test, there was a significant difference between all groups ($p \leq 0.001$), except between the 12- to 24-month group and the > 24-month group ($p = 0.11$), regarding leg pain change (Δ NRS leg pain score). The Δ NRS leg pain score decreased with a pain duration in excess of 12 months (3.8 for pain duration < 3 months, 3.9 for 3–12 months, 3.4 for 12–24 months, and 3.1 for > 24 months), as illustrated in Fig. 2 and Table 3. Final analyses with linear multiple regression and after adjusting for independent variables showed that the preoperative duration of leg pain was a significant predictor regarding the Δ NRS leg pain score ($p = 0.002$).

TABLE 1. Baseline values in the stratified duration cohorts

	Preop Pain Duration, Mos				p Value
	<3	3–12	12–24	>24	
Total no. of pts	935	3613	933	735	
Age, yrs					0.0024
Mean	43.2 ± 9.8	41.7 ± 10.7	41.3 ± 11.9	41.9 ± 11.3	
Median (range)	43 (18–64)	42 (18–64)	41 (18–64)	41 (18–64)	
Sex					0.41
Male	559 (59.9%)	1952 (54.1%)	511 (54.9%)	447 (60.9%)	
Female	374 (40.1%)	1659 (45.9%)	419 (45.1%)	287 (39.1%)	
No. of pts w/ missing data	2	2	3	1	
BMI, kg/m ²					0.0086
Mean	26.5 ± 9.8	26.3 ± 4.4	26.7 ± 4.6	26.7 ± 4.4	
No. of pts	891	3447	888	701	
Smoker					0.010
No	811 (87.5%)	3157 (88.3%)	796 (86.3%)	614 (84.2%)	
Yes	116 (12.5%)	419 (11.7%)	126 (13.7%)	115 (15.8%)	
No. of pts w/ missing data	8	37	11	6	
Analgesic use					<0.0001
No	77 (8.4%)	350 (9.7%)	132 (14.2%)	102 (13.9%)	
Yes, occasionally	175 (19.0%)	897 (25.0%)	320 (34.5%)	292 (39.8%)	
Yes, regularly	667 (72.6%)	2346 (65.3%)	475 (51.2%)	339 (46.2%)	
No. of pts w/ missing data	16	20	6	2	
Level of LDH					0.27
L3	79 (8.4%)	134 (3.7%)	40 (4.3%)	31 (4.2%)	
L4	392 (41.9%)	1487 (41.2%)	417 (44.7%)	317 (43.1%)	
L5	449 (48.0%)	1950 (54.0%)	466 (49.9%)	376 (51.2%)	
Sacral	15 (1.6%)	42 (1.2%)	10 (1.1%)	11 (1.5%)	
PROMs					
NRS leg pain					<0.0001
Mean	7.53 ± 2.20	6.99 ± 2.15	6.87 ± 2.19	6.69 ± 2.27	
Median (range)	8 (0–10)	7 (0–10)	7 (0–10)	7 (0–10)	
No. of pts	900	3557	909	717	
NRS back pain					<0.0001
Mean	4.70 ± 3.05	4.76 ± 2.81	5.37 ± 2.72	5.61 ± 2.66	
Median (range)	5 (0–10)	5 (0–10)	6 (0–10)	6 (0–10)	
No. of pts	902	3544	908	716	
ODI					<0.0001
Mean	57.6 ± 19.5	46.9 ± 17.1	43.8 ± 16.7	43.4 ± 17.2	
Median (range)	58 (0–100)	46 (0–100)	42 (0–98)	42 (0–100)	
No. of pts	890	3526	905	715	
EQ-VAS					<0.0001
Mean	40.9 ± 23.3	45.8 ± 21.6	47.1 ± 20.9	48.2 ± 22.8	
Median (range)	40 (0–100)	45 (0–100)	50 (0–100)	50 (0–100)	
No. of pts	835	3329	866	666	
EQ-5D					<0.0001
Mean	0.122 ± 0.342	0.267 ± 0.335	0.289 ± 0.340	0.314 ± 0.345	
Median (range)	0.055 (–0.594 to 1)	0.159 (–0.594 to 1)	0.159 (–0.594 to 1)	0.193 (–0.484 to 1)	
No. of pts	902	3560	918	719	

EQ-VAS = EuroQol VAS; EQ-5D = EuroQol 5D questionnaire; pt = patient.

Values are presented as n (%) for categorical variables and mean ± SD, median (range), and total no. of patients for continuous variables. For comparison between groups, the Mantel-Haenszel chi-square test was used for ordered categorical variables and the Jonckheere-Terpstra test was used for continuous variables.

TABLE 2. Baseline surgical results in the entire cohort

	Preop Score	12-Mo Follow-Up Score	Score Change	p Value
NRS leg pain				<0.0001
Mean $\pm$ SD	7.02 $\pm$ 2.19	2.16 $\pm$ 2.62	-4.83 $\pm$ 3.17	
Median (range)	7 (0–10)	1 (0–10)	-5 (-8 to 10)	
95% CI	6.96–7.07	2.08–2.24	-4.73 to -4.93	
No. of pts	6083	4045	3967	
NRS back pain				<0.0001
Mean $\pm$ SD	4.94 $\pm$ 2.83	2.51 $\pm$ 2.52	-2.30 $\pm$ 3.09	
Median (range)	5 (0–10)	2 (0–10)	-2 (0–10)	
95% CI	4.87–5.02	2.43–2.59	-4.73 to -4.93	
No. of pts	6070	4045	3962	
ODI				<0.0001
Mean $\pm$ SD	47.5 $\pm$ 17.9	17.6 $\pm$ 16.7	-29.3 $\pm$ -20.5	
Median (range)	46 (0–100)	12 (0–84)	-28 (-48 to 94)	
95% CI	47.1–48.0	17.1–18.1	-28.6 to -29.9	
No. of pts	5684	4038	3964	
EQ-VAS				<0.0001
Mean $\pm$ SD	45.5 $\pm$ 21.9	73.5 $\pm$ 20.1	27.6 $\pm$ 26.3	
Median (range)	45 (0–100)	80 (0–100)	27 (0 to -96)	
95% CI	45.0–46.1	72.8–74.1	28.5 to -26.8	
No. of pts	5359	3966	3675	
EQ-5D				<0.0001
Mean $\pm$ SD	0.254 $\pm$ 0.343	0.734 $\pm$ 0.272	0.465 $\pm$ 0.394	
Median (range)	0.157 (-0.594 to 1)	0.796 (-0.484 to 1)	0.529 (-0.594 to 0.837)	
95% CI	0.246–0.263	0.725–0.742	-0.477 to 0.453	
No. of pts	5737	4067	4022	

For comparisons within groups, the Fisher nonparametric permutation test for matched pairs was used. The total number of patients included in the analysis was 6216.

Duration of Sciatic Leg Pain and GA Score—Postoperative Perception of Leg Pain Decrease

In total, 36.61% (n = 1490) of the patients rated their postoperative sciatic leg pain as completely recovered. A further 40.54% (n = 1650) of patients reported major improvement, 13.76% (n = 560) reported some improvement, and 8.13% (n = 331) reported unchanged or worse pain. The distribution (%) according to the stratified preoperative duration of sciatica of this PROM and Δ NRS is illustrated in Fig. 3.

There was a significant difference between the duration groups regarding the leg pain GA score ($p < 0.001$). A larger proportion of patients had unchanged or worse radiating leg pain in the groups with a pain duration in excess of 12 months compared to those with 0–12 months of pain. There was more than twice the risk of leg pain being rated as “unchanged” (GA score 4, OR 2.41, 95% CI 1.81–3.21, $p < 0.0001$) or “worse” (GA score 5, OR 2.08, 95% CI 1.46–2.97, $p < 0.0001$), as illustrated in Table 4.

Duration of Sciatic Leg Pain and Satisfaction With the Final Surgical Outcome

The overall satisfaction rate with the surgical outcome at the 1-year postoperative follow-up in the entire cohort

was 80.1% (n = 3226), whereas 13.5% (n = 544) of patients reported themselves to be uncertain with the postoperative result and 6.4% (n = 258) were dissatisfied.

Comparison of the stratified sciatica duration groups (Table 5) revealed a significant difference regarding the patient satisfaction rating at the 1-year follow-up ($p < 0.0001$). The largest proportions of satisfied patients were seen in the 2 groups with sciatic leg pain duration < 3 months or 3–12 months (83.5% and 82.5%, respectively) compared to the groups with longer pain durations, 12–24 and > 24 months (74.9% and 72.2%, respectively). Multiple logistic regression analysis showed higher odds of being satisfied with the surgical outcome in the groups with a shorter duration of sciatic leg pain compared with those with a duration > 24 months. An analysis of ODI and EQ-5D results demonstrated significant improvements in all subgroups, but intergroup differences did not reach clinically relevant thresholds for these assessment instruments.

Discussion

The main findings of the study were that patients with a shorter duration (0–12 months) of preoperative symptoms reported a significantly larger decrease in postopera-

FIG. 2. The stratified duration groups and leg pain decrease (Δ NRS score) following LDH surgery. Figure is available in color online only.

tive residual pain measured by the NRS and better results concerning their GA score for leg-specific pain, as well as reported a higher degree of general satisfaction with the surgical procedure.

This study shows a statistically significant improvement in the NRS leg pain score after LDH surgery regardless of the preoperative leg pain duration, which is in accordance with previous work.^{5,19} The largest NRS leg pain score improvement was seen in the group with a sciatica duration < 3 months (score change -5.59 vs -3.85 for > 24 months of pain duration). Analysis with linear multiple regression confirmed that the duration of preoperative leg pain was a significant predictor of postoperative Δ NRS leg pain decrease and was demonstrated to be a negative factor for Δ NRS score decrease after a duration > 3 months. In a previous Danish register study ($n = 2586$), groups with a

preoperative pain duration < 3, 3–12, or > 12 months were compared. These patients were also found to have had a significant improvement regarding leg pain in all groups postoperatively at the 1-year follow-up.⁷

In our national cohort, patients with a duration of leg pain < 12 months had a significantly higher chance of being satisfied with the surgical outcome at the 1-year follow-up compared to those with > 12 months' duration of sciatica. In particular, it is striking that with > 12 months of preoperative pain duration there was twice the risk of experiencing unchanged or worsening leg pain symptoms.

In this study, the exact reason for patients with a longer duration of symptoms having worse outcomes can only be speculated upon, but most likely the cause is multifactorial. Patients with a prolonged duration (> 24 months) of sciatica were more likely (OR 1.77, $p = 0.0002$) to report

TABLE 3. Duration of preoperative sciatic leg pain and mean difference in Δ NRS leg pain score between the groups

Preop Pain Duration, Mos	Comparison Group, Mos	No. of Pts	Mean Difference Btwn Groups (95% CI)*	p Value†
<3 ($n = 935$)	3–12	3613	0.6 (0.3–0.8)	<0.001
	12–24	933	1.4 (1.0–1.8)	<0.001
	>24	735	1.7 (1.3–2.1)	<0.001
3–12 ($n = 3613$)	12–24	933	0.8 (0.5–1.1)	<0.001
	>24	735	1.1 (0.8–1.4)	<0.001
12–24 ($n = 933$)	>24	735	0.3 (0.0–0.7)	0.11

Adjusted for the covariates age, sex, level of disc herniation, smoking, and BMI using ANCOVA.

* Calculation of the confidence interval for continuous variables is based on bootstrapping of 10,000 replicates, picking the 2.5 and 97.5 percentiles of the 10,000 mean differences as the confidence interval.

† For comparison between groups, the Fisher nonparametric permutation test was used for continuous variables. $p < 0.05$ was considered statistically significant.

FIG. 3. The stratified duration groups, GA score of leg pain improvement after surgery, and leg pain decrease (Δ NRS score). Figure is available in color online only.

dissatisfaction or uncertainty regarding their final surgical outcome compared to patients with < 3 months of preoperative leg pain. Earlier studies support roles played by somatic, psychological, and social factors and suggest that a combination of these can be used to predict if patients are at risk for developing persistent pain.²⁰ In this large cohort, there were statistically significant differences between the duration groups in both pre- and postoperative as well as change scores for PROM values. These mean intergroup values increased following surgery but reached commonly used minimal clinically important difference values for only a few measurements. Based on our results,

we believe it is of utmost importance to be aware of the worse outcome reported by the patients with a long (> 12 months) preoperative pain duration, to provide the correct phrasing and information on expected results and indicate the higher risk for dissatisfied patients reporting less favorable results in this group.

Study Strengths and Limitations

The major strength of our study is the large sample size and national coverage of Swespine. Included in our data set is almost every Swedish hospital performing spinal

TABLE 4. Entire cohort stratified into 2 pain duration groups (<12 and >12 months) with GA leg pain outcomes postoperatively

	Preop Pain Duration*		OR (95% CI)	Mean Difference (95% CI)
	<12 Mos	>12 Mos		
Preop				
No leg pain†	1% (30)	0.8% (9)	0.83 (0.39–1.75)	0.2% (–14.0% to 14.3%)
Postop				
Pain free	39.1% (1168)	29.8% (322)	0.66 (0.57–0.77)	9.3% (3.4% to 15.2%)
Much better	41.4% (1236)	38.3% (414)	0.88 (0.76–1.02)	3.1% (–2.5% to 8.6%)
Somewhat better	12.4% (370)	17.6% (190)	1.51 (1.25–1.83)	–5.2% (–12.0% to 1.6%)
Unchanged	3.7% (110)	8.4% (91)	2.41 (1.81–3.21)	–4.7% (–12.4% to 3.0%)
Worse	2.5% (75)	5.1% (55)	2.08 (1.46–2.97)	–2.6% (–11.0% to 5.8%)

For categorical variables, the percentage (n) of patients is presented. For comparison between groups, the Mantel-Haenszel chi-square test was used for ordered categorical variables ($p < 0.0001$).

* In the < 12-month group, data for 1559 patients were missing. In the > 12-month group, data for 587 patients were missing.

† These patients claimed to have no preoperative leg pain on the 1-year follow-up questionnaire but had all stated preoperatively that they had pain.

TABLE 5. Association between preoperative duration of sciatic leg pain and patient satisfaction with surgical outcome

Preop Pain Duration, Mos	No. of Pts w/ Missing Data	Uncertain/Dissatisfied	Satisfied	OR (95% CI) (dichotomous)	p Value	AUC (95% CI)
>24 vs >24 (ref)	265	128 (27.2%)	342 (72.8%)	1.00		
<3 vs >24	357	101 (17.5%)	477 (82.5%)	1.77 (1.32–2.38)	0.0002	0.56
3–12 vs >24	1233	418 (17.6%)	1962 (82.4%)	1.76 (1.40–2.21)	<0.0001	(0.53–0.58)
12–24 vs >24	333	155 (25.8%)	445 (74.2%)	1.07 (0.82–1.41)	0.61	

AUC = area under the receiver operating characteristic curve.

The total number of patients included in final analysis was 4028. All tests were performed with univariable logistic regression. The variables were age, sex, BMI, smoking, analgesic usage, employment status, educational level, sickness benefit, physical activity level, and EQ-5D, ODI, and EQ-VAS scores. p values, OR, and AUC are based on original values and not on stratified groups. The OR is the ratio for the odds of a predictor increase of 1 unit.

surgery, and it thus encompasses surgical discectomy cases from hundreds of spinal surgeons with varying degrees of experience and surgical methods, reflecting a truly generalized sample of surgeons and surgical techniques. In previous RCTs designed to study surgical timing of LDH procedures, it might be problematic to generalize a single center- or surgeon series, or to interpret the strength and validity of clinical outcomes in the presence of treatment arm crossover, and loss to follow-up. Therefore, large cohort studies provide an important complement to proper clinical decision making regarding timing of LDH surgeries by individual surgeons.^{5,6,21}

One limitation of the present study is that no data on the particular reasons for the length of pain duration from initiation of symptoms to surgery were available for this cohort. Factors such as patient and doctor delays and access to surgery may all play a role. Furthermore, in register studies in general compared to other study designs, a high number of patients are lost to follow-up. However, previous prospective observational studies with a high follow-up rate compared PROMs at 1- and 2-year follow-ups in the Swespine and Norspine (Norwegian spine register) and demonstrated comparable figures; the results indicate robustness despite patient data loss.^{22–24} This finding supports the strength of the register as a robust and trustworthy source of data even if there is a considerable loss to follow-up.

The inclusion and exclusion criteria applied in this study were utilized to select patients undergoing surgery for a first-time LDH. By excluding all patients undergoing concurrent fusions or decompressions for spinal stenosis or degenerative disc disease, the aim was to remove as many surgical confounding factors as possible. Other than the duration of sciatic leg pain, there could have been contributing factors influencing the results that were not controlled for. Despite having prospective data and the possibility of adjusting for confounding factors in the statistical regression model, we can only adjust for registered covariates. Furthermore, those variables that we have adjusted for are known confounders, and thus to avoid introducing the risk of selection bias, we have only adjusted for clinically relevant and apparent variables. Subjective errors in measurement can be introduced by patient misunderstanding of qualitative questions and recall bias. With a register-based study, one cannot simply conclude that a shorter duration of sciatic leg pain per se leads to better outcomes, but our findings strongly support this theory.

Conclusions

Patients with the shortest preoperative leg pain duration (< 3 months) reported superior outcomes in all measured parameters. More significantly, using 12 months of pain duration as a cutoff, our results indicate that patients who had a lumbar discectomy with a preoperative sciatic leg pain duration < 12 months experienced a larger reduction in leg pain and were more satisfied with their surgical outcome and perception of postoperative leg pain than those with > 12 months of sciatic leg pain.

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Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author Contributions

Conception and design: Beck, Westin, Baranto. Acquisition of data: Beck, Baranto. Analysis and interpretation of data: all authors. Drafting the article: Beck, Westin, Baranto. 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: Beck. Statistical analysis: Beck, Westin, Brisby. Administrative/technical/material support: all authors. Study supervision: Westin, Brisby, Baranto.

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