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REVIEW ARTICLE

Surgery for Lumbar Disc Herniation and Future Risk for Long-Term Sick Leave: A Two-Year Prospective Swedish Cohort Study of 5842 Patients of Working Age

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Abstract

Even if lumbar disc-herniation (LDH)-surgery is rather common, there is little knowledge on future sick leave. The aim of this study was to explore risk factors for having many sick-leave days following lumbar disc-herniation surgery.

Methods: A prospective cohort study, using microdata linked from four nationwide Swedish registers was conducted. We included all patients in Sweden who, when aged 25-60 years, had a first LDH-surgery in 2007-2009 and at surgery date were not on disability pension for more than half-time. We followed them prospectively regarding sick-leave days intwo years after surgery date. Descriptive analyses were conducted regarding sociodemographics, rehospitalization, mortality, as well asprevious and future sick leave. Multivariate logistic regressions were used to calculate odds ratios (OR) with 95% confidence intervals (CI) for having had more than 180 sick-leave days after the LDH-surgery.

Results: We identified 5842 patients and 28% of them had > 180 sick-leave days in the first 365 days following surgery. There was an association between having had > 90 sick-leave days before surgery and having > 180 sick-leave days after surgery, both in the first (OR 5.3; CI 95%: 4.7-6.0) and in the second year postoperative (OR 4.0; CI 95%: 3.4-4.8), as there was with female sex andbeing born outside of Sweden. Associations between age and educational level with sick-leave days after surgery were significantly weaker.

Conclusion: The results show that patients with > 90 sick-leave days before surgery, female sex, and being born outside of Sweden have a statistically significant higher risk of > 180 sick-leave days in the first and second year following LDH-surgery date.

This study contributes to deepen the knowledge about sick leave following spine surgery. Several patients have long-term sick leave following spine surgery, and further studies are needed to find if this can be prevented.

Keywords

Lumbar disc herniation, Lumbar disc herniation surgery, Sick-leave, Prospective cohort study

List of Abbreviations

LDH: Lumbar Disc-Herniation

Introduction

Lumbar disc herniation (LDH) has been shown to be associated with both morbidity and significant high social costs, the latter due to that the majority of the patients are of working age [1,2].

Disc herniation in the spine occurs as a result of disc degeneration where the outer sheath of the intervertebral disc (anulus fibrosus) is penetrated by the central part of the disc (nucleus pulposus) [3]. The penetration is generally directed in central or lateral posterior direction. Disc herniation often leads to mechanical compression and/or tension to the adjacent nerve root. Herniation also leads to chemical stress with release of substance P, phospholipase 2, and vasoactive intestinal peptide from the nucleus pulposus leading to inflammation of the nerve root. The lumbar level in

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spine is most commonly affected for disc herniations, and the two lower disc segments in the lumbar spine (between L4 and L5 and between L5 and S1) account for more than 90% of all symptomatic disorders due to disc herniation.

A classic LDH disorder often starts with acute pain, followed by radiating pain in one or both legs, so called sciatica [4]. In a cross-sectional study from the early 1980's, it is described that 40% of the population at some point suffer from sciatic pain while only 1-2% are diagnosed with disc herniation [5]. With improved diagnostics using magnetic resonance imaging (MRI) in later studies of persons without symptoms, disc herniation has been detected in just over 60% of examined individuals [6,7]. The findings stress the need of careful clinical examination for the treatment of back pain and sciatica and confirm the previously known weak link between radiological changes in the back and the occurrence of back symptoms.

Symptomatic LDH has usually a good prognosis with spontaneous regression of symptoms after a few weeks to a month [8]. The treatment aims to reduce pain and increase the functional level to as normal physical activity level as possible. Since the natural course is generally good, surgical extirpation of herniated discscan often be avoided. The indication for surgery is almost always relative, only in the case of cauda-equina syndrome (disc herniation that threatens the control of urinary and intestinal function by affecting sacral nerve roots), the indication is absolute, and emergency surgery is necessary. In other cases, surgery is performed on pain indication when medication and/or physiotherapy have an insufficient effect.

Surgery of lumbar disc hernia can be performed in various ways, either with microsurgical technique or with open technique when the disc hernia is extirpated. The pain-relieving effect of a surgical procedure after a failed conservative regimen is well-documented [9]. Early surgical treatment of acute LDH also provides faster symptom relief compared to non-operative treatment [10,11].

The risk ofrelapse appears to be low. Jansson, et al. [12] showed that the frequency of reoperation within 1 year and 10 years was 5% and 10%, respectively, and that 78% of the patients had only one treatment occasion, which suggests that re-hospitalization due to reoperation is low. Also, complications to surgery were relatively rare. Against an international comparison, the operating frequency in Sweden is low; during a 10-year period, the annual mean incidence of disc herniation surgery was 24 surgeries per 100,000 inhabitants in Sweden during the 1980s and 1990s [12]. The corresponding proportion has been documented in Sweden since the mid-1950s [13]. This can be compared with 40 and 70 surgeries per 100,000 inhabitants and year in Finland and the US, respectively [14,15]. Although most people with symptomatic LDH are restored without surgery, [9] it has been suggested that surgical intervention could present increased likelihood of recurrence [16].

Previous studies have shown that long preoperative sick-leave as well as the duration of leg pain [17] were associated with prolonged sick-leave following LDH surgery [1]. However, those studies included a lower number of patients (n = 132 and 678, respectively) and were based on patients selected from a specific clinic [17] or on survey data, involving drop outs, etc. [1]. Larger studies, without dropouts or selections regarding type of clinic etcetera are needed.

Aims

This explorative study aimed to map risk factors for large numbers of sick-leave days following LDH surgery, with a particular focus on demographics and socio-economic factors as well asnumber of sick-leave days before surgery.

Primary question; do many sick-leave days (> 90 days) before the LDH surgery involve a higher risk for large numbers of sick-leave days (> 180 days) in year one and in year two following the surgery date? Secondary issues; are sex, age, country of birth, educational level, or re-hospitalization associated with risk of a large number of sick-leave days during the first and the second year after the surgery date?

Methods

A prospective cohort study was conducted.

Source of data

The study was based on anonymized microdata from the following four Swedish nationwide registers from three governmental authorities; the National Board of Health and Welfare's inpatient register and cause of death register (for inclusion and exclusion), the Statistics Sweden's longitudinal integration database for health insurance and labor market studies (LISA) (for sociodemographic information), and the Swedish Social Insurance Agency's analysis database (MiDAS) (disability pension status at surgery date and for sick-leave days before and after surgery date). Data were linked at individual level by use of the unique personal identity number (PIN) assigned to all residents of Sweden [18].

In Sweden, the employer provides sick pay for the first two weeks of a sick-leave spell, thereafter the Social Insurance Agency provides sick-leave benefits [19]. Therefore, we only included sick-leave days in sick-leave spells exceeding 14 days. All residents with income from work can, from age 16 claim sick-leave benefits if their work incapacity is reduced due to disease or injury.

Selection procedure

From the nationwide patient register, we identified all patients who had a first-time discectomy- or lumbar decompression surgery due to a disc herniation, when aged 25 to 60 years, inany of the years 2007-2009. Only procedures involving one level discectomy or decompression were included. All patients with multiple, fusion, and/or fixation procedures, and procedure performed due to cauda equine diagnose were excluded. All who died during follow-up (< 1%) were excluded as were all on disability pension for more than half-time at the date of surgery (n = 787; 12%), as they were not at risk of the outcome (sick leave).

Outcome measures

The outcome measure was > 180 sick-leave days in the first year and in the second year, respectively, following the date of surgery.

Other variables

The following sociodemographic data were used: Age, sex, born in Sweden or in another country, educational level (primary school (< 10 years), high school (10-12 years,or college/university (> 12 years)), > 90 sick-leave days in the 365 days before surgery date, and re-admission after the index procedure (more than one in-patient day in the first 365 days).

Statistical methods

All crude demographic and socioeconomic data following the selection were summarized as frequencies for categorical data, and means and medians with associated standard deviations for continuous data.

Uni- and multivariate logistic regression analysis were used to investigate possible associations of age, sex, country of birth, educational level, preoperative sick-leave days, and postoperative re-hospitalization (odds ratios (OR) with 95% confidence intervals (CI)) with > 180 sick-leave days during the first and second follow-up year, respectively, after surgery date. A significance level of 0.05 was also presented. The first year = the first 365 days after surgery date.

Ethical considerations

The project was approved by the Regional Ethical Review Board in Stockholm, Sweden.

Results

Following the selection procedure, a total of 5842 patients were included. Their mean number of sick-leave days in the first year following index procedure was140 days (SD 123 days) and in the second year 59 days (SD 112 days) (Table 1). A total of 28% (n = 1654) of

Table 1: Sociodemographic information for the cohort of patients with a first lumbar disc herniation surgery in 2007-2009 when aged 25-60 years (n = 5842); among all and stratified for those with less or more than 180 sick-leave days in the first and second year after surgery date, respectively.

		All		First year after surgery date				Second year after surgery date			
				≤ 180 sick-leave days		> 180 sick-leave days		≤ 180 sick-leave days		> 180 sick-leave days	
		N	%	N	%	N	%	N	%	N	%
Age at surgery	< 45	2928	50	2195	52	733	44	2587	52	341	42
	45-55	1893	32	1300	31	593	36	1585	32	308	38
	> 55	1021	17	693	17	328	20	851	17	170	21
Sex	Women	2648	45	1746	42	902	55	2192	44	456	56
	Men	3194	55	2442	58	752	45	2831	56	363	44
Country of birth	Sweden	4967	85	3630	87	1337	81	4309	86	658	80
	Other	875	15	558	13	317	19	714	14	161	20
Level of education	Primary	949	16	600	14	349	21	773	15	176	21
	Secondary	3122	53	2209	53	913	55	2691	54	431	53
	University	1771	30	1379	33	392	24	1559	31	212	26
Sick-leave days one year prior to surgery	<= 90 days	3707	63	3139	75	568	34	3436	68	271	33
	> 90 days	2135	37	1049	25	1086	66	1587	32	548	67
Rehospitalisation first year after surgery	No	4486	77	3389	81	1097	66	3983	79	503	61
	Yes	1356	23	799	19	557	34	1040	21	316	39
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Number of sick-leave days	1st year after surgery	140	123	67	46	310	64	112	103	302	104
	2nd year after surgery	59	112	19	57	152	148	15	36	308	62
Total		**5842**		**4188**		**1654**		**5023**		**819**	

the individuals had > 180 sick-leave days in the first year after surgery date. The corresponding proportion was 14% (n = 819) in the second year after surgery.

Both univariable and multivariate regression analyses showed a strong association between having had > 90 sick-leave days before surgery date and having > 180 sick-leave days after surgery (Table 2). This association was seen for both the first and second year after surgery. A total of 51% of the individuals (1086/2135) with > 90 sick-leave days prior to surgery had > 180 sick-leave days the first year after surgery compared to 15% (568/3707) of those with ≤ 90 sick-leave days, adjusted OR 5.3 (CI95%: 4.7-6.0). The corresponding association was also seen for the second year after surgery when only 7% (271/3707) of the individuals with ≤ 90 sick-leave days before surgery had > 180 sick-leave days the second year after surgery date, compared to 26% (548/2135) of those with > 90 sick-leave days (adjusted OR 4.0 (CI95%: 3.4-4.8).

Significant associations were also seen for female sex, where 34% (902/2648) of the women had > 180 sick-leave days the first year after surgery compared to 24% (752/3194) for men.

The corresponding adjusted ORs were 0.6 for men compared to women (CI 95%: 0.6-0.7) in the first follow-up year and 0.7 (CI95%: 0.6-0.8) in the second year. Re-hospitalization in the year after surgery date was associated with > 180 sick-leave days after surgery, 34% (557/1654) versus 19% (799/4188) for those with ≤ 180 sick-leave days), OR 2.2 (CI95%: 1.9-2.6). Significant associations were also found for patients not born in Sweden; 36% (317/875) of them compared to 27% (1337/4967) of the Swedish-born patients had > 180 sick-leave days the first year after the surgery (OR 1.5 (CI95%; 1.2-1.7)). The corresponding association remained in year 2 after surgery (OR 1.4 (CI95%: 1.1-1.7)).

Weak associations were also seen for the age group 45-54 years (OR 1.2; CI 95%: 1.0-1.4) compared to those < 45 years. Moreover, of those aged 45-54 years 31% (593/1893) had ≥ 180 sick-leave days the first year after surgery compared to 25% (733/2928) for those < 45 years (Table 2). Corresponding results were also seen in year 2 (OR 1.3; CI 95%: 1.1-1.6). There were no significant differences in ORs for > 180 sick-leave days in the first and second follow-up year between those aged

Table 2: Logistic regression analysis for factors associated with ≥ 180 sick-leave days during the first and second year after lumbar disc herniation surgery date.

	Risk of > 180 SA days, first year after surgery		**Risk of > 180 SA days, second year after surgery**	
	Univariable	**Multivariable**	**Univariable**	**Multivariable**
	Odds ratios (95% CI)	Odds ratios (95% CI)	Odds Ratios (95% CI)	Odds Ratios (95% CI)
Age at surgery:				
< 45	*Reference*	*Reference*	*Reference*	*Reference*
45-55	1.37*** (1.20 - 1.55)	1.19* (1.03 - 1.37)	1.47*** (1.25 - 1.74)	1.30** (1.09 - 1.55)
> 55	1.42*** (1.21 - 1.66)	1.27** (1.07 - 1.51)	1.52*** (1.24 - 1.85)	1.35** (1.10 - 1.67)
Sex:				
Women	*Reference*	*Reference*	*Reference*	*Reference*
Men	0.60*** (0.53 - 0.67)	0.63*** (0.56 - 0.72)	0.62*** (0.53 - 0.72)	0.67*** (0.57 - 0.79)
Country of birth:				
Sweden	*Reference*	*Reference*	*Reference*	*Reference*
Other	1.54*** (1.32 - 1.79)	1.47*** (1.24 - 1.74)	1.48*** (1.22 - 1.78)	1.37** (1.12 - 1.68)
Level of education:				
Primary	*Reference*	*Reference*	*Reference*	*Reference*
Secondary	0.71*** (0.61 - 0.83)	0.80* (0.67 - 0.95)	0.70*** (0.58 - 0.85)	0.79* (0.65 - 0.98)
University	0.49*** (0.41 - 0.58)	0.62*** (0.51 - 0.75)	0.60*** (0.48 - 0.74)	0.77* (0.61 - 0.97)
Sick-leave days one year prior to surgery				
<= 90 days	*Reference*	*Reference*	*Reference*	*Reference*
> 90 days	5.72 *** (5.06 - 6.47)	5.31 *** (4.68 - 6.04)	4.38 *** (3.74 - 5.13)	4.04 *** (3.44 - 4.76)
Rehospitalisation first year after surgery				
No	*Reference*	*Reference*	*Reference*	*Reference*
Yes	2.15*** (1.89 - 2.45)	2.23*** (1.93 - 2.56)	2.41*** (2.06 - 2.81)	2.36*** (2.01 - 2.78)

$^{*}p < 0.05$ $^{**}p < 0.01$ $^{***}p < 0.001$

< 45 and those aged > 55 years. Moreover, there were no differences in ORs between people with different educational levels.

Discussion

Summary of findings

In this first explorative prospective cohort study of working-aged patients with first-time LDH surgery, we found that 72% had less than 180 sick-leave days in the first year (365 days) after the surgery date. There was a positive association between a high number of sick-leave days (> 90 days) prior to surgery and a high number of sick-leave days (> 180 days) after surgery, both during the first and second postoperative years. Female sex, born outside of Sweden, and re-hospitalization during the first year after surgery were also associated with a high number of sick-leave days up to two years after surgery.

Relationship to previous research

Most other studies in this area are based on smaller, often selected patient groups and focus in most of them are (time to) return to work, rather than number of sick-leave days. Nevertheless, the previous research tends to find, as we did, that many sick-leave days prior to LDH surgery are associated with long-term sick leave in the years following surgery. Digs, et al. [20] showed similar results in a prospective cohort study of 122 patients surgically treated for LDH; female sex as well as psychologically demanding work were unfavourable prognostic factors for return to work. Andersen, et al. [1] presented in a prospective single center study with 678 patients that the proportion of patients returning to work decreases significantly with the length of preoperative sick leave; they found that 83% returned to work if they underwent surgery within three months, as opposed to 50% of those who had a sick-leave spell of more than three months.

Grövle, et al. [21] found in a prospective cohort study with 466 LDH patients that patients with radiating sciatic symptoms of more than three months as well as those with previous radiating sciatic disorders had a significantly longer time to return to work. In that study, 75% of patients returned to full-time work within 2 years. Prognostically favorable factors were mild initial symptoms and good general health; unfavorable results were seen in those treated with surgery. This finding is, however, most likely a result of selection bias with a higher proportion of patients with severe symptoms treated with surgery as opposed to those treated non-operatively.

Other studies have shown that sick-leave length before surgery is also associated with the outcome following surgery for LDH. A prospective study by Nygaard, et al. [17] found that prolonged duration of leg pain and longer preoperative sickleave were predictive factors for negative outcome following surgery for LDH. Silverplats, et al. [22] also foundthat shorter preoperative sickleave was associated with favorable outcome following LDH surgery.

Bloch, et al. [23] reviewed different medical interventions aiming to promote return to work in working-aged patients on sick leave due to low back pain since at least three months. The study covered six countries and only one such intervention was associated with faster return to work, namely lumbar spine surgery, and only in one country: Sweden. This was understood to be due to narrower indications for such surgery in Sweden than in the other countries. Most patients did not receive surgery and some procedures had low clinical indication and were often performed after extended sickleave. In other studies, early surgery (within a few weeks) has proved to be beneficial, with faster symptom regression, lower indirect costs for sick leave, but at the expense of higher direct medical costs [1,24,25]. Although several studies indicate more rapid return to work after surgery, a general recommendation to operate all patients with LDH cannot be defended as the majority of patients can be expected to have a spontaneous regression of symptoms [9].

The fact that back pain not only affects physical function, but also can give rise to anxiety and depression is well known [9]. Several psychosocial factors can contribute to reducing work capacity for a long time. In a systematic review, Huysmans, et al. found that the best predictors of sick-leave duration, apart from lateral disc prolapse and preoperative level of pain or disability, were symptoms of depression or occupational mental stress [26]. Also, den Boer, et al. [27] showed in a prospective cohort study of 182 patients that returning to work six months after LDH surgery was adversely affected by passive coping strategies for pain management, fear of pain, and physically heavy work. Other authors describe that psychosocial stress is one of the best documented risk factors for adverse events in low back pain with or without sciatic disorders [28-30]. Screening tools for identifying patients at risk of long-term sickleave have, e.g., been used in Denmark for both neck distortion [31] and lumbar spine pain [32]. This type of instrument enables identification of subgroups with different predictions, which can facilitate differentiated and individualized care. Patients with good prognosis can be offered standardized treatment while risk patients can be offered an individualized specialist care.

Strengths and limitations

The strengths of this study are its prospective cohort design, the large and well-defined nation-wide cohort of all patients with a first LHD surgery in Sweden - not a selection from specific clinics nor a sample - and that microdata could be linked at individual level from several high-quality registers [33-35]. Other strength are the long-term follow-up period of two years for each patient, and that this could be done from surgery date, rather than using calendar year, and that all data were administrative, not self-reported information affected by recall bias.

Limitations of this study are the lack of clinical data on the level of disability, co-morbidities, and sick-leave diagnoses before and after surgery, both spine-related and other diagnoses are possible causes of their sick leave. Sick-leave spells shorter than 15 days (due to the Swedish social insurance system and its regulation) were not included, which can be seen as both a limitation and a strength, results not being affected by colds, migraines, stomach flues, etcetera. Another limitation is that we were unable to correct for the essentially two different surgical methods (microsurgical technique and open discectomy). However, it is unlikely that the surgical method isassociated with long-term sick leave.

Conclusion

The majority of patients surgically treated for LDH had fewer than 180 sick-leave days during the first year following the procedure. However, the risk of having > 180 sick-leave days the first year after surgery was significantly higher for those who had been on sick leave > 90 days in the year before surgery, this higher risk was also persistent in the second year following the surgery. Female sex and born outside of Sweden were also associated with a higher risk for > 180 sick-leave days. Age and educational level displayed significantly weaker associations with sick leave after surgery. The results of this first explorative study indicate that further studies on risk factors for long-term sick leave following LDH surgery are warranted-especially as long-term sick leave sometimes is an indicator for performing such surgery.

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Conflict of interest

Authors report no conflict of interest.

Authors Declaration

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All authors contributed equally in the drafting, statistics, analysis and writing of this work.

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