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ORIGINAL ARTICLE

Life dissatisfaction is associated with a poorer surgery outcome and depression among lumbar spinal stenosis patients: a 2-year prospective study

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Abstract The aim of this study was to examine the life satisfaction of lumbar spinal stenosis (LSS) patients up to the 2-year postoperative phase. Patients ($N = 102$, mean age, 62 years) with symptomatic LSS underwent decompressive surgery. Data collection took place with the same set of questionnaires before surgery and 3 months, 6 months, 1 year and 2 years postoperatively. Life satisfaction was assessed with the four-item Life Satisfaction scale and depression symptoms with the 21-item Beck Depression Inventory (BDI). In addition, a depression burden variable was included, comprising the sum of preoperative, 3- and 6-month BDI scores. Physical functioning and pain were assessed with the Oswestry disability index, Stucki questionnaire, self-reported walking ability, visual analogy scale and pain drawing. Two years postoperatively, 18% of the LSS patients was dissatisfied with their lives. As a whole, the life satisfaction of the LSS patients improved during the postoperative follow-up, reaching the level of the healthy adult Finnish population. However, 2 years postoperatively, dissatisfied patients reported significantly more pain, a poorer functional ability and more depressive symptoms and depression than the patients who were satisfied with life. This difference was seen throughout the postoperative follow up. In regression analyses, the only significant associations were between the depression burden and postoperative life dissatisfaction. Thus, subjective well-being as well as depression among LSS patients should be assessed pre- and postoperatively in order to enable early intervention for those at risk of poorer life satisfaction.

Keywords Spinal stenosis · Life satisfaction · Surgery outcome · 2-Year follow-up · Depressive symptoms

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Introduction

The inclusion of subjective assessments by patients has become a standard procedure when assessing the outcome in spinal surgery [4, 7, 26]. A recent study [11] maintained that the main parameters determining a good outcome in spinal surgery were achieving the patients' expectations or satisfaction with the results, pain relief, the alleviation of

disability and social reintegration. These aims were defined both by patients and physicians [11]. However, in this context, the satisfaction with life of lumbar spinal stenosis (LSS) patients after spinal surgery has not yet been explored. Generally, the relative benefit of surgical treatment for LSS diminishes over time due to the natural course of this degenerative disease [2, 3, 14]. Nonetheless, the outcome of surgery has still been found favourable 2 years postoperatively [3, 40], including postoperative improvement in the health-related quality of life [12].

In the general population, life satisfaction, measured with a four-item Life Satisfaction (LS) scale, has been found strongly associated with self-rated health as well as objectively assessed physical health [20]. Indeed, life dissatisfaction is associated with several indicators of poor health or health risk factors, such as the severity and symptoms of somatic disease and use of medication [13, 17], morbidity [17], mortality [19, 21], premature work disability [24] and particularly with depressive symptoms [16, 18, 22]. As an indicator of subjective well being, life satisfaction is also one of the main dimensions of mental health [38]. Thus, assessing life satisfaction with only four questions enables the identification of those at risk of adverse health outcomes, both mentally and physically.

In our previous study [35], we observed that 25% of preoperative LSS patients was dissatisfied with their lives, while this proportion among healthy Finns is about 13% [17]. Preoperatively, life dissatisfaction was associated with a younger age, greater physical comorbidity, pain and constraints on everyday functioning. However, life satisfaction among postoperative LSS patients has not been assessed, although it is an important outcome measure and an indicator of mental health and the general health prognosis. The aim of this study was therefore to examine life satisfaction in LSS patients up to the 2-year postoperative phase.

Materials and methods

Study design

Selection for surgery at Kuopio University Hospital, Finland, was made by an orthopaedist or neurosurgeon between October 2001 and October 2004. The three inclusion criteria were: (1) the presence of severe back, buttock, and/or lower extremity pain, with radiographic evidence (computed tomography, magnetic resonance imaging or myelography) of compression of the cauda equina or exiting nerve roots by degenerative changes (ligamentum flavum, facet joints, osteophytes and/or disc material), (2) the surgeon's clinical evaluation that the patient had degenerative LSS requiring operative treatment and (3) a history of ineffective responses to conservative treatment.

The exclusion criteria were: (1) emergency or urgent spinal surgery precluding recruitment and protocol investigations, (2) cognitive impairment prohibiting the completion of the questionnaires or other failures in co-operation or (3) the presence of such metallic particles in the body that prevented MRI investigation of the lumbar spine (primarily excluding all the patients with heart pacemakers. Patients with a knee or hip prosthesis were included.) However, a previous spine operation or co-existing disc herniation was not an exclusion criterion. The surgeons sent information on potential study patients to the Department of Physical and Rehabilitation Medicine, which organized the study [34, 35].

The follow-up data were collected preoperatively and 3 months, 6 months, 1 year and 2 years postoperatively. The patients were informed about the study protocol during their outpatient visit to the Department of Physical and Rehabilitation Medicine and their informed consent was obtained. The study design was approved by the Ethics Committee of the University of Kuopio and Kuopio University Hospital.

The study subjects were assigned to one of the two treatment groups using two-block randomization. The group assignment was performed after inclusion in the study without being revealed to the study subjects. Patients were randomized to an active (A) rehabilitation group ($N = 50$) and a basic (B) group ($n = 52$). Group A received weekly training with a physiotherapist (starting 3 months postoperatively, lasting 12 weeks) at the Department of Physical Medicine and Rehabilitation of Kuopio University Hospital. The aim of the intervention was to improve postoperative muscle fitness of the hip, thighs, abdominal and lower back muscles as well as to increase postoperative muscle stretchability. Intervention for group A was repeated from 12 to 15 months after the operation (once a week, 12 times) to motivate training and update the training program if needed. Patients in group B received standard postoperative care stipulated by the surgeon or their general practitioner. In case they asked for advice, a "stay active" message was given by the study personnel.

Data collection took place with the same set of questionnaires before surgery and 3 months, 6 months, 1 year and 2 years postoperatively. Questions were included about the socio-demographic background, lifestyle and health of the patients. Somatic comorbidity was assessed with the self-reported number of current or recurring somatic diseases diagnosed by a physician. This is one modified item (item number 3) of the Work Ability Index questionnaire [37]. The following items were also included: self-reported walking capacity, the visual analogy

scale (VAS) for assessing the overall intensity of back and leg pain (range 0–100 mm) [29] and a modified pain drawing to locate pain and numbness [27]. Patients marked the sensations felt in various parts of the body on a schematic map that was further divided into 100 cells (range 0–100). Subjective disability was measured by the validated Finnish version of the Oswestry disability index, where 0% represents no disability and 100% extreme, debilitating disability [8–10]. Furthermore, the questionnaire devised by Stucki [36] assessed LSS-related symptom severity, physical disability and postoperative satisfaction with higher scores indicating more LSS-related problems and dissatisfaction. The questionnaire was translated into Finnish by one of the authors (TA) and a native English speaker checked the translation. There are currently no published validation studies using the Finnish version of the Stucki questionnaire. It consists of three scales: (1) a seven-question scale on symptom severity, (2) a five-question physical disability scale and (3) six postoperative satisfaction questions. In the symptom severity subscale, all but one item had Likert response scales with five categories scored 1–5 (none, mild, moderate, severe, very severe). In the physical disability subscale, all but one item had Likert response scales with four categories (no, could not perform; yes, but always with pain; yes, but sometimes with pain; yes, comfortably). The postoperative satisfaction questions had Likert response scales with four categories (very satisfied, somewhat satisfied, somewhat dissatisfied, very dissatisfied). All the scale scores were calculated as the unweighted means of all item responses, the ranges of the two last scales being 1–4. However, the postoperative satisfaction scale was only included in the follow-up questionnaires.

Depressive symptoms were assessed with the Finnish version of the 21-item Beck Depression Inventory (BDI) with scores ranging from 0 to 63 [5, 30]. The cut-off point for depression was set at 14/15, 0–14 indicating normal mood and 15 or more indicating depression based on a previous study [39]. The cumulative score for the depression burden comprised the sum of the preoperative, 3- and 6-month BDI scores.

Life satisfaction was assessed with the 4-item self-reported LS scale [1]. For each item (A–D), subjects chose the statement that best described their experience when asked "Do you feel that your life at present is…" (response scores in parenthesis): A. very interesting (1), fairly interesting (2), fairly boring (4) or very boring (5); B. very happy (1), fairly happy (2), fairly unhappy (4) or very unhappy (5); C. very easy (1), fairly easy (2), fairly hard (4) or very hard (5). The last question, "Do you feel that at the present you are…" had the following response alternatives: D. very lonely (5), fairly lonely (4) or not at all lonely (1). The item responses "cannot say" were scored as 3. The sum scores were analysed continuously or dichotomously, with scores of 4–11 indicating satisfaction and scores of 12–20 indicating dissatisfaction with life [17, 18].

Study sample

Altogether, 102 subjects participated in this study. They were both clinically and radiologically defined as suffering from LSS and selected for surgical treatment. However, BDI data were not obtained from two of the study patients at baseline ($n = 100$), from three subjects on 3-month follow-up ($n = 99$) and from five subjects on 6-month follow-up ($n = 97$). At the final 2-year follow-up ($n = 96$), four patients had died, one patient had dropped out and one patient had missing BDI data. The collection of sample data has been described in more detail by Sinikallio et al. [34, 35].

According to a self-report questionnaire [37], the most common somatic diseases of the baseline study patients were musculoskeletal diseases (in addition to LSS) and concomitant circulatory diseases. The former included pain and degeneration in the extremities (reported by 41% of the patients), cervical pain and degeneration (33%), disc herniation (13%) as well as rheumatoid arthritis (3%). The latter included arterial hypertension (46%), coronary artery disease (17%), a history of myocardial infarction (7%) and cardiac insufficiency (4%).

Statistical analyses

All statistical analyses were performed using SPSS/PC (version 14.0., SPSS, Chicago, IL, USA).

Statistical methods included the χ^2 test or Fisher's exact test with class variables and the Student's t test or the Mann–Whitney U test with continuous variables depending on the distribution. Statistical analyses were performed using the data for the final 96 subjects on 2-year follow-up.

Logistic regression analysis (method: enter) was used to examine the preoperative factors independently associated with dissatisfaction with life (LS scores 12–20) on 2-year follow-up. We used three separate models to specifically examine the preoperative and early recovery (3- and 6-month follow-up) depression variables. The relevant background factors and clinically relevant variables were included in the analyses. The following factors were included as the basic covariates in the multivariate logistic regression analyses, regardless of the model (method enter): sex (male: no/yes), baseline somatic comorbidity [over median (5): no/yes], physiotherapy group (standard postoperative care: no/yes) and marital status (single: no/yes) as categorical variables and age (years), the Oswestry disability score, VAS score, pain drawing markings and BDI score as continuous variables. Due to

multicollinearity, the depression variable was included in the second step of the regression model.

In model 2, instead of the BDI score, a depression burden variable was included. In model 3, instead of continuous score, a categorized depression burden [depression burden $\geq$ median (20 points): no/yes] variable was included.

Results

The proportion of patients who were dissatisfied with life at different follow-up points and the respective mean LS scores are presented in Table 1. An improvement was evident but not linear during the follow-up. There were neither significant differences in the 2-year mean life satisfaction scores of the LSS patients between the basic physiotherapy group (mean 8.5, SD 2.73) and the active physiotherapy group (mean 8.3, SD 3.38), nor there were significant differences between the randomized groups in the mean change in life satisfaction scores from the 3-month to the 2-year follow-up: the mean change in scores was −0.11 (SD 2.65) in the basic physiotherapy group and 0.45 (SD 3.07) in the active physiotherapy group ($t = -0.96$, $df = 93$, $P > 0.05$).

The baseline and 2-year follow-up characteristics of the surgically treated LSS patients in relation to life satisfaction are presented in Table 2. According to self-reports at the 2-year postoperative stage, seven study patients had been using antidepressant medication during the follow up.

Two years postoperatively, when comparing the patients according to their life satisfaction status [satisfied (LS 4–11) vs. dissatisfied (LS 12–20)], the dissatisfied patients reported significantly more pain, a poorer functional ability and more depressive symptoms and were more often categorized as having depression than the patients who were satisfied with life. This difference was evident regardless of the studied clinical variable (Stucki scores, Oswestry, VAS, pain drawings, walking capacity, BDI scores, percentage of depressed patients; Table 3). Similar differences were also observed regardless of the follow-up phase (3-month, 6-month or 1-year). At all follow-ups the dissatisfied patients reported significantly more pain (VAS), a poorer functional ability (Oswestry, Stucki symptom severity) and more depressive symptoms (BDI scores) than the patients who were satisfied with life (data not shown).

On 2-year postoperative follow-up, none of the baseline variables in model 1 was significantly associated with life satisfaction, i.e. age, sex, marital status, postoperative comorbidity, physiotherapy group, Oswestry disability score, VAS score, pain drawing markings or BDI score (Table 3).

In logistic regression model 2 (with the depression burden variable), an independent association was seen between the depression burden and postoperative dissatisfaction with life. No other significant associations emerged. In Table 3, only the odds ratios for the depression burden variable are presented for this model.

Finally, in model 3 (with a categorized depression burden variable), a high depression burden was independently and strongly associated with dissatisfaction with life 2 years postoperatively. No other significant associations emerged. In Table 3, odds ratios are only presented for the high depression burden variable in model 3.

Discussion

Despite increasing interest in subjective well-being measures in assessing the outcome of LSS surgery, the postoperative life satisfaction of LSS patients has not been previously examined. According to this study, significant improvement in subjective life satisfaction took place during a 2-year postoperative follow-up among LSS patients. Second, throughout the follow up, the dissatisfied patients reported significantly more pain, a poorer functional ability and more depressive symptoms and depression than the patients who were satisfied with life. This difference was evident regardless of the clinical variable examined. Third, life dissatisfaction on 2-year postoperative follow-up could not be predicted by any single preoperative somatic variable. The only significant independent associations were seen between depression burden (both as a continuous and a categorized variable) and postoperative life dissatisfaction. As depression burden comprised the sum of preoperative, 3- and 6-month BDI scores, even cumulative sub-threshold depressive symptoms were taken into account.

Table 1 Proportion of patients who were dissatisfied with life at different follow-up points and the respective mean LS scores

	Preoperative phase	3-Month follow-up	6-Month follow-up	1-Year follow-up	2-Year follow-up
Proportion of dissatisfied patients (%) (LS score 12–20)	25	18	20	22	18
Mean LS score among all the patients [mean (SD)]	9.4 (3.3)	8.6 (3.3)	8.5 (3.2)	8.9 (3.5)	8.4 (3.1)

Table 2 Background and clinical characteristics of the lumbar spinal stenosis patients preoperatively and on 2-year postoperative follow-up in relation to life satisfaction

Variable	Preoperative phase ($n = 100$)	2-Year follow-up all ($n = 96$)	Satisfied ($n = 79$)	Dissatisfied ($n = 17$)
Age at baseline [mean (SD)]	61.7 (11.1)	–	62.2 (11.2)	60.8 (11.0) ns[a]
Male	60.2 (11.9)			
Female	62.9 (10.5)			
Gender: male (%)	42	41		
Physiotherapy group				
Basic ($n = 48$) (%)			52	41 ns
Active ($n = 48$) (%)			48	58
Stucki score [mean (SD)]				
Severity	3.3 (0.6)	2.5 (0.7)	2.3 (0.7)	3.1 (0.6)***
Disability	2.5 (0.5)	1.8 (0.7)	1.6 (0.6)	2.4 (0.6)***
Postoperative satisfaction		1.9 (0.7)	1.8 (0.5)	2.7 (0.7)***
Oswestry % [mean (SD)]	43.7 (15.2)	26.4 (19.3)	22.2 (16.9)	46.0 (17.7)***
VAS, mm [mean (SD)]	32.8 (23.9)	11.6 (16.9)	8.3 (13.5)	29.1 (21.9)**
Pain drawing (markings) [mean (SD)]	22.6 (19.5)	16.4 (19.6)	13.1 (16.4)	31.5 (25.7)***
Self-reported walking capacity, metres [mean (SD)]	1463.3 (1818.7)	2727.8 (2963.0)	3021.7 (3125.9)	1361.8 (1444.1)**
BDI score [mean (SD)]	10.2 (6.0)	7.6 (5.9)	6.2 (5.0)	14.1 (5.8)***
Depressed (%)	20.0	13.5	6.3	47.1***
Life satisfaction score [mean (SD)]	9.4 (3.3)	8.4 (3.1)	7.2 (1.7)	13.9 (1.8)***
Dissatisfied with life (%)	25	18	–	–

SD standard deviation, *ns* non-significant,

$^{**}P < 0.01$, $^{***}P < 0.001$

[a] *t*-test/Mann–Whitney/χ^2 tests comparing satisfied (life satisfaction score 4–11) and dissatisfied (life satisfaction score 12–20) patients

Table 3 Multiple logistic regression models with (+) and without (-) depression variables in relation to life dissatisfaction (life satisfaction scores 12–20) on 2-year follow-up

Variable	Step (−) OR (95% CI)	Step (+) OR (95% CI)
Model 1		
Age (years)	0.97 (0.90–1.03)	0.98 (0.91–1.05)
Sex (male: no/yes)	0.90 (0.24–3.43)	0.63 (0.15–2.76)
Preoperative marital status (single: no/yes)	2.10 (0.59–7.51)	1.62 (0.41–6.46)
Preoperative somatic comorbidity [≥ median (5): no/yes]	3.08 (0.68–14.07)	2.44 (0.51–11.74)
Physiotherapy group (basic: no/yes)	1.93 (0.54–6.91)	1.97 (0.54–7.21)
Preoperative Oswestry % (continuous score)	1.02 (0.97–1.07)	1.00 (0.94–1.05)
Preoperative VAS (continuous score)	1.01 (0.97–1.07)	1.02 (0.99–1.05)
Preoperative pain drawing (markings: continuous score)	1.01 (0.97–1.04)	1.01 (0.98–1.05)
Preoperative depression (continuous BDI score)	–	1.10 (0.98–1.24)
Model 2		
Depression burden (the sum of pre-operative, 3- and 6-month BDI scores)	–	1.06 (1.01–1.11)*
Model 3:		
Depression burden ≥ median (20 points): no/yes	–	5.50 (1.11–27.24)*

OR odds ratio, *CI* confidence interval

$^{*}P < 0.05$

The majority of the patients displayed a clear improvement in their pain and disability ratings at the end of the follow up. Life satisfaction also improved, reaching the level of the general population [17]. While 25% of the LSS patients was dissatisfied with life preoperatively, the proportion at the end of the follow-up decreased to 18%

[35]. This is to be expected after surgical treatment for a painful and disabling illness such as LSS. However, in the general population, the proportion of the dissatisfied has been reported as 13% among the healthy and 25% among those categorized as ill [17]. Thus, postoperative LSS patients were better off than ill people in the general population on average, which can be considered as a good result for the operation.

Nevertheless, a slight fluctuation in life satisfaction scores was observed during the follow up. The mean life satisfaction score among healthy adult Finns has been found to be 8.2 [23], whereas that of our study patients at the 2-year postoperative phase reached 8.4. While life satisfaction has been shown to be highly stable in the general population [23], this was not the case with LSS patients receiving surgical treatment, but no previous longitudinal data on LSS patients exist.

Our previous study [35] among LSS patients revealed that dissatisfaction with life was associated with elevated disability, more extensive pain and depressive symptoms in the preoperative phase. According to the present study, this phenomenon was evident throughout the postoperative follow up. It is notable that the mode of postoperative physiotherapy intervention showed no effect with respect to the life satisfaction of LSS patients at the 2-year postoperative phase. Thus, a lack of life satisfaction is largely associated with self-ratings of pain, disability and mood in LSS patients. This should encourage the use of measures aimed directly at promoting mental health and well being in spinal rehabilitation settings.

Interestingly, out of studied predictor variables, only the depression burden was independently associated with 2-year postoperative life dissatisfaction. This finding is clinically relevant, since depression may be a chronic disorder with remissions and relapses. The depression burden was based on cumulative depressive symptoms during the follow up (preoperative, 3- and 6-month), including sub-threshold depressive symptoms. Previous studies have shown that they also have adverse effects, such as an increased risk for functional, health and mood impairment [6, 31]. Thus, it is important to detect and treat depression among patients with chronic somatic disease.

The assessment of patient disability and mobility was based on self-ratings. It is well known that subjective estimates of physical states may be biased [25, 28, 33]. In addition, there may be disagreement between self-reported and test-based mobility estimates [15, 32]. The inclusion of objective mobility measurements might clarify this issue.

As reported previously [35], despite the university hospital setting, the study patients represented ordinary LSS patients treated operatively at the secondary care level. The patients had various somatic comorbidities, as is often the case with clinical samples. This, however, could be regarded as strength of the present study, since the results are applicable to normal clinical practice. However, caution must be exercised when drawing causal or long-term conclusions from this 2-year observational study. Whether detecting and possibly treating depressive symptoms in LSS patients would actually improve their postoperative life satisfaction and associated pain and disability remains to be answered by future intervention studies.

In conclusion, our results show that despite improvements, 18% of the LSS patients were still dissatisfied with their lives 2 years after surgery. Furthermore, the dissatisfied patients reported significantly more pain, a poorer functional ability and more depressive symptoms than the patients who were satisfied with life. This difference was seen throughout the postoperative follow up. Interestingly, no single preoperative somatic variable, but only the depression burden was independently associated with 2-year postoperative life dissatisfaction. Thus, the subjective well being and particularly depressive symptoms in LSS patients preoperatively, in the early recovery phase and in rehabilitation deserve attention. The assessment of subjective well being among LSS patients should be encouraged in clinical practice. The 4-item LS scale is an easily administered and well-accepted [23] tool for this. As life dissatisfaction is strongly associated with concurrent and future depressive symptoms, our results also call for practices to detect and treat depression among postoperative LSS patients.

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