The Influence of Pre- and Postoperative Fear Avoidance Beliefs on Postoperative Pain and Disability in Patients with Lumbar Spinal Stenosis: Analysis of the Lumbar Spinal

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Abstract: STUDY DESIGN: Prospective multi-center cohort study. OBJECTIVE: To evaluate the effect of pre- and postoperatively assessed fear avoidance beliefs (FAB) on pain and disability in patients with degenerative lumbar spinal stenosis (LSS) after decompression surgery. SUMMARY OF BACKGROUND DATA: To the present, the influence of pre- and postoperative FAB on the prognosis after surgery for LLS is still unclear. METHODS: Patients of the Swiss Lumbar Stenosis Outcome Study (LSOS) with confirmed LSS undergoing first-time decompression without fusion were enrolled in this study. The main outcome of this study was minimal clinically important difference (MCID) in SSM symptoms (pain) and function (disability) after twelve months. To analyze the influence of pre- and postoperatively assessed FAB on pain and disability we built simple and multiple logistic regression models. RESULTS: In this analysis of 234 patients undergoing decompression surgery for symptomatic degenerative LSS we found baseline FAB measured by the FAB physical activity subscale (FABQ-P) not to be associated with pain (OR 0.95; 95% CI: 0.55-1.67) and disability (OR 1.11; 95% CI: 0.64-1.92) at twelve months' follow-up. In the final multiple logistic regression models patients with high FABQ-P at six months (OR 0.46; 95% CI: 0.24-0.91) and high persistent FABQ-P at baseline and six months (OR 0.34, 95% CI: 0.16-0.73) were less likely to report a MCID for SSM symptoms at twelve months. Our analysis found a similar trend for disability, however, the results were not statistically significant. CONCLUSIONS: In elderly patients undergoing decompression surgery for symptomatic degenerative LSS preoperative fear avoidance beliefs were not a prognostic indicator for the outcome. Patients with FAB at six months and persistent FAB were less likely to experience clinically relevant improvement in pain at twelve months. Studies should address the importance of persistent postoperative FAB.

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The influence of pre- and postoperative fear avoidance beliefs on postoperative pain and disability in patients with lumbar spinal stenosis: Analysis of the Lumbar Spinal Outcome Study (LSOS) data

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A Swiss prospective multi-center cohort study

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Abstract

Study design: Prospective multi-center cohort study.

Objective: To evaluate the effect of pre- and postoperatively assessed fear avoidance beliefs (FAB) on pain and disability in patients with degenerative lumbar spinal stenosis (LSS) after decompression surgery.

Summary of Background Data: To the present, the influence of pre- and postoperative FAB on the prognosis after surgery for LLS is still unclear.

Methods: Patients of the Swiss Lumbar Stenosis Outcome Study (LSOS) with confirmed LSS undergoing first-time decompression without fusion were enrolled in this study. The main outcome of this study was minimal clinically important difference (MCID) in SSM symptoms (pain) and function (disability) after twelve months. To analyze the influence of pre- and postoperatively assessed FAB on pain and disability we built simple and multiple logistic regression models.

Results: In this analysis of 234 patients undergoing decompression surgery for symptomatic degenerative LSS we found baseline FAB measured by the FAB physical activity subscale (FABQ-P) not to be associated with pain (OR 0.95; 95% CI: 0.55-1.67) and disability (OR 1.11; 95% CI: 0.64-1.92) at twelve months' follow-up. In the final multiple logistic regression models patients with high FABQ-P at six months (OR 0.46; 95% CI: 0.24-0.91) and high persistent FABQ-P at baseline and six months (OR 0.34, 95% CI: 0.16-0.73) were less likely to report a MCID for SSM symptoms at twelve months. Our analysis found a similar trend for disability, however, the results were not statistically significant.

Conclusions: In elderly patients undergoing decompression surgery for symptomatic degenerative LSS preoperative fear avoidance beliefs were not a prognostic indicator for the outcome. Patients with FAB at six months and persistent FAB were less likely to experience clinically relevant improvement in pain at twelve months. Studies should address the importance of persistent postoperative FAB.

Key Words: laminotomy; decompression; lumbar spine; spinal canal stenosis; lumbar spinal stenosis; multi-center; outcome; surgery; fear; fear avoidance

Level of Evidence: 3

Introduction

Low back pain (LBP) with its global prevalence of 9.4% constitutes a high health and economic burden on individuals.[1] Lumbar spinal stenosis (LSS) is an important subgroup of LBP patients. In the United States, LSS is the most frequent indication for spine surgery in patients older than 65 years.[2] However, there is a wide variation in rates of improvement in patients after surgery.[3,4] Various factors may influence chronic postsurgical complaints being a major concern because it can affect patient recovery and quality of life after surgery.[5,6] Preoperatively assessed psychological factors including fear and pain catastrophizing were associated with more postoperative pain.[7] On the other hand, high postoperative fear was also associated with poorer outcomes as postoperative pain intensity and disability.[8] How fear and catastrophizing influence the postoperative course in patients with LSS has not yet fully understood.

The fear-avoidance model is a widely used theoretical model to explain psychological factors in the experience of pain and the development of chronic pain and disability.[9] Negative beliefs about pain and / or negative illness information may lead to an exaggerated negative mental response where the worst possible outcome is imagined (pain catastrophizing). This catastrophizing response to a painful experience leads to pain-related fear and avoidance behaviors. Avoidance behavior results in disuse, disability and depression, and maintains the original negative appraisal in a deleterious cycle.[9] On the other hand it is assumed that patients without catastrophizing thoughts and fear avoidance beliefs are more likely to confront pain and are more active in the coping process.[9] While in non-specific low back pain the importance of fear avoidance beliefs and catastrophizing thoughts on the prognosis and treatment efficacy has been shown,[10-13] their influence in patients with LSS has not been investigated. How surgery influences postoperative fear avoidance beliefs is not well understood. One study showed a postoperative reduction in fear avoidance beliefs in patients undergoing surgery for degenerative spinal conditions.[8] To date no study investigated the influence of pre- and postoperative fear avoidance beliefs on the prognosis after surgery for LLS.

The aim of this study is to evaluate the effect of high pre- and postoperative fear avoidance beliefs on pain and disability in patients with degenerative lumbar spinal stenosis after decompression surgery.

Materials and Methods

Patient Selection

We used data from the Lumbar Stenosis Outcome Study (LSOS),[14] a multi-center prospective cohort study, to explore this issue. Patients with a history of neurogenic claudication were recruited from outpatient clinics at all participating centers. Eligible patients had no evidence of stenosis caused by tumor, fracture, infection, or significant deformity (>15° lumbar scoliosis), and were aged 50 years or more. Magnetic Resonance Imaging (MRI) verified lumbar spinal canal stenosis. None of the patients had prior lumbar spine surgery. Furthermore, patients had no clinical peripheral artery occlusive disease (confirmed by a vascular specialist in patients without palpable pulses in the lower limb).

Surgical Procedure

Surgery consisted of a standard open or microscopic posterior lumbar decompression at the affected level or levels without instrumentation.

Questionnaires

Fear Avoidance Beliefs Questionnaire (FABQ): The FABQ[15] is a 16-item questionnaire. High values indicate increased levels of fear avoidance beliefs. Two subscales exist: a seven-item work subscale (FABQ-W; range 0-42) and a four-item physical activity subscale (FABQ-P; range 0-24). The FABQ and the two subscales have been shown to be reliable and valid for the measurement of fear avoidance beliefs. The Cronbach α value for the FABQ-P was 0.75 (test-retest reliability, r=0.64)and for the FABQ-W0.82 (test-retest r=0.80).[16] In this study we did not use the FABQ-W

because most patients were retired.

Spinal Stenosis Measure (SSM): The SSM, an instrument specifically developed for spinal stenosis patients by Stucki et al.,[17] targets to measure severity of symptoms and quantifies disability of the lumbar spinal stenosis population. This instrument is recommended by the North American Spine Society (NASS) and used in different studies on lumbar spinal stenosis.[18-21] It consists of three different subscales; *the symptom severity subscale (score range 1-5, best-worst)*, *the physical function subscale (1-4)* and the *satisfaction subscale (1-4).*

EQ-5D-3L: The EQ-5D-3L is an assessment tool to quantify health-related quality of life. It quantifies general non-disease specific health-related quality of life, including physical, mental and social dimensions.[22] It can be calculated as a sum score (score range 0-100, worst-best).[22] The second part of the questionnaire estimates patient's *actual health* status (score range 0-100, worst-best).

Hospital Anxiety and Depression Scale (HADS): The HADS was originally developed to measure anxiety (score range 0-21, best-worst) and depression (0-21) in a hospital setting,[23] however, it is nowadays common to use it in all settings.[24]

Data Collection and Follow-up

Parts of the basic data sheet were interview-administered and recorded by a study coordinator. All other questionnaires were self-administered and filled in by the patients themselves. All data were collected at baseline, six and twelve months.

Prognostic indicator

We defined FABQ-P to qualify as a prognostic indicator if the score of FABQ-P influenced the course of the disease after adjustment for potential confounders.

Cutoff value for high FABQ-P

We used a cutoff value for high FABQ-P of >16 points based on the 75th percentile at six months according to Grotle et al.[25]

Outcomes

The main outcome of this study was clinically meaningful improvement in SSM symptoms and function, which is denoted as MCID (minimal clinically important difference), after twelve months.

The MCID is defined as "the smallest difference in a score that is considered to be worthwhile or important".[26] Thus, the MCID is a threshold for a relevant change in an outcome measure. Patients who reached or even exceed this threshold consider this change as meaningful and worthwhile. According to Stucki et al.,[17] MCID for SSM is reached when "Symptom Severity scale" improve at least 0.48 points and "Physical Function scale" at least 0.52 points at the 6- or 12-month follow-up.

Statistical analyses

Analysis of data consisted of descriptive statistics of patient demographics and outcomes. Continuous and ordinal scaled variables were shown as median and interquartile ranges, and categorical variables were shown as numbers and percentages of total.

To analyze the influence of pre- and postoperatively assessed fear avoidance beliefs (FAB) on pain and disability we built different models for MCID in SSM symptoms and SSM function, respectively.First, continuous FABQ-P at baseline and continuous FABQ-P at six months, respectively, were the potential prognostic indicators in the models Ia and Ib. Dichotomous FABQ-P >16 at baseline (high FABQ-P-0) and FABQ-P >16 at six months (high FABQ-P-6), respectively, were entered in the models IIa and IIb. Persistent high FABQ-P >16 at baseline and at six months (high FABQ-P-persistent) entered in model III. In the models Ia and Ib, we first fitted a non-linear effect within the generalized additive model framework in order to verify or falsify the linearity

assumption of the continuous prognostic indicator.

Potential confounders were selected a priori in an interdisciplinary consensus (xx, xx, xx, xx, xx, xx) and based on the current literature.[27,28] Demographic variables were age and gender (entered as continuous and categorical variable in the model, respectively), socio-economic variables were education (low education defined as compulsory education), and civil status (single, divorced, and widowed as risk factor), general health (presence of comorbidities (including osteoarthritis of the hip or knee, chronic lung disease, cardiac disease, and neurologic diseases) and body mass index (BMI, continuous variable), psychological health (anxiety (HADS anxiety score ≥8), depression (HADS depression score ≥8), and fear avoidance beliefs (FABQ-P >16), and current episode (duration of complaints <3 months, 3-6 months, 6-12 months, >12 months), baseline SSM symptoms, SSM function, and EQ-5D sum score.

To reduce the number of confounders included in the multiple regression model simultaneously, we used an approach based on change in the specific estimated effect of FABQ-P on each of the dichotomous outcomes. We considered those variables to be confounders that changed this effect by more than ± 10%.[29]

Some of the potential confounders had a small percentage of missing values (ranging from 0.4% to 4.7%). We used multiple imputation based on chained equations (with five replications) to obtain data sets without missing values.[30] The multiple imputation was based on the above described set of confounders, FABQ-P, and SSM symptoms and function. Pooled effect estimates were obtained with Rubin's formula.[31]

All analyses were conducted with R for Windows.[32]

Ethics

This multi-center cohort study was conducted in compliance with all international laws and regulations as well as any applicable guidelines. The study was approved by the independent Ethics Committee of the Canton Zurich (KEK-ZH-NR: 2010-0395/0).

Results

Patient characteristics

Between December 2010 and August 2015 1537 patients were potentially eligible, and 800 patients agreed to participate (**Figure 1**, study flow). Decompression surgery was performed in 331 patients. For this study, 234 patients (71%) completed the twelve months follow-up until the end of August 2015 and were included in the analysis.

In **Table 1** we present the patients baseline characteristics for all patients and patients with low FABQ-P (194 patients with FABQ-P ≤16 at baseline and/or at six months follow-up) and patients in group high FABQ-P-persistent (40 patients with FABQ-P >16 at baseline and six months follow-up).

Continuous FABQ-P at baseline and at six months as prognostic indicator – model Ia and Ib

In the model Ia we found that the effect of cont. FABQ-P-0 was not linear on MCID in SSM symptoms and disability, respectively, at twelve months. Therefore, the linearity assumption was falsified and we restrained from further analysis.

In the model Ib, the effect of FABQ-P was linear on MCID in SSM symptoms and disability. The estimated OR for a one unit change in FABQ-P-6 was 0.95 (95% CI: 0.92-0.99) and 0.96 (95% CI: 0.93-1.00) for MCID in SSM symptoms and disability, respectively, at twelve months.

High FABQ-P-0 (at baseline) as prognostic indicator – model IIa

We found in the simple logistic regression analysis almost no effect of high FABQ-P-0 for MCID in SSM symptoms at twelve months (OR 0.95; 95% CI: 0.55-1.67) and for MCID in SSM function at twelve months (OR 1.11; 95% CI: 0.64-1.92). The minimal effect of FABQ-P-0 on all outcomes might have resulted in an overestimated effect of confounders. Therefore, we restrained from

further confounder analysis.

High FABQ-P-6 (at six months) as prognostic indicator – model IIb

In the model IIb we found in the simple logistic regression analysis an effect of high FABQ-P-6 for MCID in SSM symptoms at twelve months (OR 0.58; 95% CI: 0.31-1.09). In the high FABQ-P-6 group patients were less likely to report a MCID than patients in the low FABQ-P-6 group (58.9% vs. 72.5%). In the final multiple logistic regression model we found that patients with high FABQ-P-6 were less likely to report MCID in SSM symptoms scale at twelve months (OR 0.46; 95% CI: 0.24-0.91) after adjustment for confounding (**Table 2**).

For disability, the simple logistic regression analysis showed an effect of high FABQ-P-6 for MCID in SSM function at twelve months (OR 0.82; 95% CI: 0.43-1.55). Patients in the high FAB-P-6 group reported similar MCID rates compared to the low FABQ-P-6 group (64.3% vs. 68.9%). In the final multiple logistic regression model patients with high FABQ-P-6 showed a trend towards less MCID in SSM function at twelve months (OR 0.64; 95% CI: 0.31-1.32) after adjustment for confounding, however, the results were not statistically significant (**Table 2**).

High FABQ-P-persistent (at baseline and six months) as prognostic indicator – model III

In the model III we found in the simple logistic regression analysis an effect of high FABQ-P-persistent for MCID in SSM symptoms at twelve months (OR 0.49; 95% CI: 0.24-0.98). The percentage of patients who reached MCID was smaller than in the low FABQ-P-persistent group (55% and 72.3%, respectively). In the multiple logistic regression model patients with high FABQ-P-persistent were less likely to report MCID in SSM symptoms at twelve months (OR 0.34, 95% CI: 0.16-0.73) after adjustment for confounding (**Table 3**).

For disability, the effect of high FABQ-P-persistent showed in the simple logistic regression analysis an effect for MCID in SSM function at twelve months (OR 0.69; 95% CI: 0.34-1.4). The percentage of patients who reached MCID was similar between the high and low FABQ-P-

persistent groups (60% and 68.6%, respectively). In the multiple logistic regression model patients with high FABQ-P-persistent were again less likely to experience MCID at twelve months (OR 0.53, 95% CI: 0.25-1.15) after adjustment for confounding. While the effect was relevant, the wide 95% CI crossed one and therefore, the effect was not statistically significant (**Table 3**).

Discussion

In this analysis of 234 patients undergoing decompression surgery for symptomatic degenerative lumbar spinal stenosis (LSS) we found baseline high fear avoidance beliefs (FAB) measured by FABQ-P not to be associated with pain of symptoms and disability at twelve months' follow-up. For continuous FABQ-P-0 we found no linear association and for FABQ-P-6 there was an effect of about 5 percent reduced chance for MCID on SSM symptoms and function per one unit change at twelve months. Patients with high FABQ-P-6 and high FABQ-P-persistent were less likely to report a MCID for SSM symptoms at twelve months. Our analysis found a similar trend for disability. However, the confidence intervals were wide indicating heterogeneity in the patient population and the effect statistically not significant.

Results compared to the literature

To date, the influence of FAB in patients with symptomatic lumbar spinal stenosis on pain and disability is hardly investigated. The influence of psychological factors on the individual experience of pain and disability is increasingly recognized.[9] Studies in patients with low back pain (LBP) support the conceptual framework of the fear-avoidance model which implies that fear of pain may lead to avoidance behavior.[9] Avoidance behavior results in disuse, disability and depression, and maintains the original negative appraisal in a deleterious cycle. In low back pain high FAB were indicators for poor outcome in the subacute phase and influenced the treatment response in conservative treatments.[12,13] In patients undergoing surgery for spinal disorders one study showed a postoperative reduction in fear avoidance beliefs.[8] Similar to our study, they found that preoperative fear of movement (measured by the Tampa Scale of kinesiophobia) was not a

prognostic factor for poor outcome. Archer et al.[8] found in their study that postoperative high scores in the Tampa Scale at six weeks and three months were associated with more pain and disability.

Wood et al.[33] compared the influence of fear of movement (measured by the Tampa Scale of kinesiophobia) in patients with lumbar spinal stenosis with neurogenic claudication to patients with claudication due to peripheral arterial disease and asymptomatic patients. In this cross-sectional study they found that persons with neurogenic claudication reported higher fear avoidance beliefs than patients with claudication due to other illnesses.

A study including 159 patients with lumbar spinal stenosis or disc herniation that underwent decompression surgery showed in a prediction model that preoperative FAB of physical activity was the only predictor for postoperative outcome (measured by using a global outcome measure) after one year.[34] In the study by Havakeshian et al.[34], FABQ-P were used on a continuous scale. Our study aimed to investigate the impact of high FABQ-P beliefs using a cutoff and therefore, increasing the clinical applicability. In our study in elderly patients with symptomatic degenerative lumbar spinal stenosis undergoing decompressive surgery high pre-operative FABQ-P were not a prognostic indicator for MCID at six or twelve months for patient reported outcomes pain and disability. High FABQ-P-6 and high FABQ-P-persistent were associated with less MCID for pain at twelve months but not for disability. One explanation could be that the FABQ-P was originally validated for low back pain patients. The wording focuses on pain and the back. In LSS patients the complaints are frequently not primarily back related or the pain itself but rather the neurogenic complaints or gait impairment. Hence, we found an association between postoperative FABQ-P and pain outcomes but not on disability. Therefore, the wording of the FABQ-P may need to be adjusted and the scale validated for this specific population. One other explanation could be that preoperative fear (fear of the pending surgery) might influence the reporting in FABQ-P. The FABQ-P does not specifically assess surgical fear and therefore, we were not able to distinguish between surgical fear and FABQ-P as negative coping strategy.[6]

Preoperative fear has been shown in patients undergoing elective surgery to be associated

with acute postoperative as well as long-term pain.[35] Our findings indicated that high FABQ-P-6 or high FABQ-P-persistent were a relevant factor for pain at twelve months but not disability. It can be hypothesized that in patients with high FABQ-P-persistent fear persists over a longer time period and so the impact will be more relevant on their ability to cope with the pain. One may also hypothesize that high fear avoidance beliefs are the result and not the cause of a worse treatment outcome. The correlations between FABQ-P-0 with symptoms and disability at baseline and the FABQ-P-6 with symptoms and disability at 6 months, respectively, were weak (data not shown). This indicates that high FABQ-P-persistent after surgery is independent from symptoms and disability a relevant prognostic indicator that may be modified by specific treatment approaches. This has to be addressed specifically in future studies.

Strength and limitations

A limitation of this study was that it was not possible to distinguish how strongly FABQ-P-0 was influenced by specifically assessed surgical fear. Furthermore, our cutoff value for FABQ-P was derived based on the 75th percentile according to a previously published study, however, a variety of other cutoff values have been proposed but none of them has been established yet. Additionally, we did not evaluate catastrophizing, and thus we were unable to assess the influence of catastrophizing on the interaction between FABQ-P and catastrophizing.

Our study has several strengths. These include the multi-center setting and prospective collection of data, as well as the use of established questionnaires on degenerative lumbar spinal stenosis. Furthermore, we had a homogenous patient sample regarding the treatment since only first-time decompression surgeries without fusions were included. Additionally, we used multiple imputation techniques to avoid potentially biased results as compared to a complete case analysis.

Implications for research

Our finding was unexpected considering that high preoperative FAB has been shown in a previous study to be a predictor of poor outcome.[34] Future studies should further investigate the importance of fear of surgery and its difference to FAB as a negative coping. In future studies on patients

undergoing surgical treatment it is advisable to use additionally a specific questionnaire assessing surgical fear, such as the Surgical Fear Questionnaire (SFQ).[35] Furthermore, it is unclear whether patients with persistent fear avoidance beliefs after surgery may benefit from specific cognitive and behavioral intervention that have been shown in other setting to modify the impact of FAB.

Implications for clinical practice

In patients undergoing surgery for degenerative lumbar spinal stenosis high FABQ-P-0 were not associated with poor prognosis. Similar to previous studies we showed that FABQ-P-6 and FABQ-P-persistent maybe important factors to consider in patients with persistent complaints.

CONCLUSIONS

In elderly patients undergoing decompression surgery for symptomatic degenerative lumbar spinal stenosis preoperative fear avoidance beliefs were not a prognostic indicator for the outcome. Patients with fear avoidance beliefs at six months and persistent fear avoidance beliefs were less likely to experience clinically relevant improvement in pain at twelve months. Studies should address the importance of persistent postoperative fear avoidance beliefs.

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Figure legends

Figure 1. Study flow

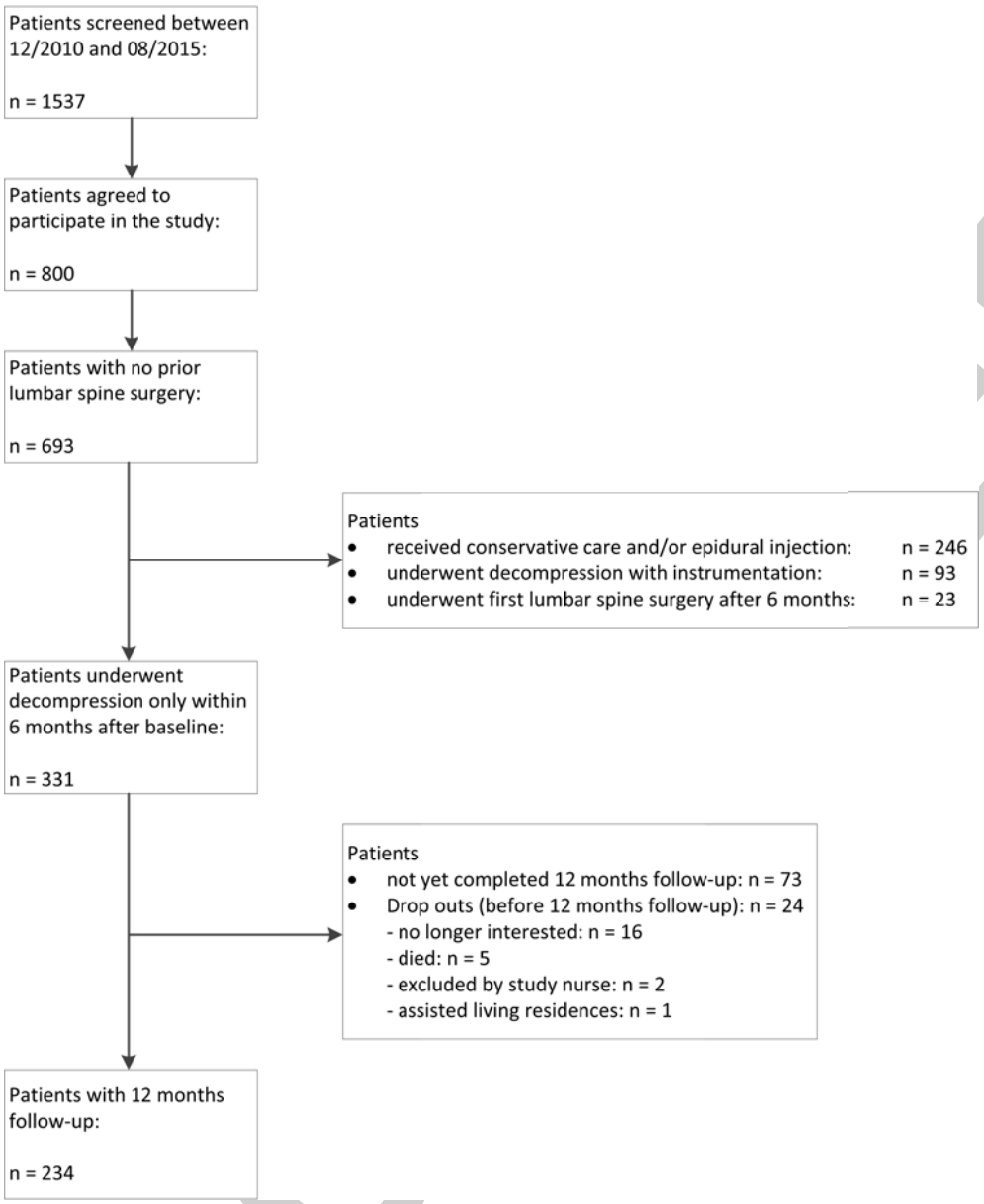

Table 1: Descriptive statistics of patients with low FABQ-P and high FABQ-P-persistent

	All	Low FABQ-P*	High FABQ-P-persistent**	p-value
n	234	194	40	
Age, years, median [IQR]	75.0 [68, 80]	75.0 [68, 80]	74.5 [68, 81]	0.9
Female, n (%)	120 (51.3)	99 (51)	21 (52.5)	0.99
BMI, kg/m2, median [IQR]	26.9 [24.3, 30.4]	26.8 [24.4, 30.3]	27.4 [23.8, 30.5]	0.97
Diabetes, n (%)	34 (14.5)	26 (13.4)	8 (20)	0.41
Education, n (%)				0.08
Compulsory school	58 (24.8)	53 (27.3)	5 (12.5)	
High school, college, university	176 (75.2)	141 (72.7)	35 (87.5)	
Civil status, n (%)				0.88
Single, divorced, widowed	94 (40.2)	77 (39.7)	17 (42.5)	
Married, registered partnership	140 (59.8)	117 (60.3)	23 (57.5)	
Duration of complaints, n (%)				0.58
<3 months	25 (10.8)	19 (9.9)	6 (15.4)	
3-6 months	42 (18.2)	36 (18.8)	6 (15.4)	
6-12 months	32 (13.9)	25 (13.0)	7 (17.9)	
>12 months	132 (57.1)	112 (58.3)	20 (51.3)	
Comorbidities, n (%)				
Coxarthrosis	32 (14.0)	25 (13.2)	7 (17.9)	0.6
Gonarthrosis	37 (16.2)	30 (15.9)	7 (17.9)	0.93
Chronic lung disease (COPD, asthma, fibrosis, others)	13 (5.7)	7 (3.7)	6 (15)	0.02
Heart failure	14 (6.1)	10 (5.3)	4 (10)	0.44
Coronary disease	17 (7.4)	11 (5.8)	6 (15)	0.09
Neuropathy	21 (9.2)	15 (7.9)	6 (15.4)	0.25
Parkinson's disease	5 (2.2)	5 (2.6)	0 (0)	0.66
SSM symptoms, median [IQR]	3.1 [2.7, 3.6]	3.1 [2.7, 3.4]	3.4 [3.0, 3.7]	0.01
SSM function, median [IQR]	2.4 [1.8, 2.8]	2.3 [1.8, 2.8]	2.7 [2, 3]	0.05
EQ5D sum score, median [IQR]	70 [60, 80]	70 [60, 80]	60 [50, 80]	0.08
HADS anxiety, n (%)				0.44
0-7	194 (82.9)	163 (84)	31 (77.5)	
8-21	40 (17.1)	31 (16)	9 (22.5)	
HADS depression, n (%)				0.3
0-7	192 (82)	162 (83.4)	30 (75)	
8-21	42 (18)	32 (16.6)	10 (25)	
FABQ-P-0 (at baseline), median [IQR]	16 [12, 20]	15 [10.8, 18]	22 [19.8, 24]	<0.01
FABQ-P-6 (at 6 months), median [IQR]	12 [4, 16.5]	8 [1.5, 14]	21 [19, 23]	<0.01

BMI: body mass index; FABQ-P: Fear Avoidance Beliefs Physical Activity Subscale; HADS: Hospital Anxiety and Depression Scale; SSM: Spinal Stenosis Measure

* FABQ-P ≤16 at baseline and/or ≤16 at six months; ** FABQ-P >16 at baseline and at six months

Table 2: Multiple logistic regression model for SSM symptoms and function for MCID reached at 12 months in patients with high FABQ-P-6 (at six months) (model IIa and IIb)

		Patients MCID reached, n (%)**	MCID at 12 months: OR (95% CI)
Pain* (SSM symptoms)	FABQ-P-6 >16	33 (58.9)	0.46 (0.24-0.91)
	FABQ-P-6 ≤16	121 (72.5)	
	SSM symptoms		2.8 (1.57-4.99)
Disability* (SSM function)	FABQ-P-6 >16	36 (64.3)	0.64 (0.31-1.32)
	FABQ-P-6 ≤16	115 (68.9)	
	BMI		0.9 (0.84-0.96)
	Duration 3-6mo		1.6 (0.43-6)
	Duration 6-12mo		1.84 (0.45-7.48)
	Duration >12mo		0.97 (0.31-3.05)
	Neuropathy Yes		0.5 (0.18-1.4)
	HADS Depression ≥8		0.53 (0.23-1.25)
	EQ5D sum score		1.01 (0.99-1.04)
	SSM symptoms		0.8 (0.44-1.46)
	SSM function		7.04 (2.36-8.63)

BMI: body mass index; CI: confidence interval; Duration: duration of symptoms FABQ-P: Fear Avoidance Beliefs Physical Activity Subscale; HADS: Hospital Anxiety and Depression Scale; SSM; Spinal Stenosis Measure

*Confounders included when a variable changed the effect between FAB and each outcome by > +/- 10% from the preselected potential confounders: age, gender, low education, civil status, presence of comorbidities, BMI, HADS anxiety score ≥8, HADS depression score ≥8, duration of complaints <3 months, 3-6 months, 6-12 months, or >12 months, baseline SSM symptoms, baseline SSM function, and baseline EQ-5D sum score.

**: raw data

Table 3: Multiple logistic regression model for SSM symptoms and function for MCID reached at 12 months in patients with high FABQ-P-persistent (at baseline and at six months) (model III)

		Patients MCID reached, n (%)**	MCID at 12 months: OR (95% CI)
Pain* (SSM symptoms)	FABQ-P-persistent >16	22 (55)	0.34 (0.16-0.73)
	FABQ-P-persistent ≤16	136 (72.3)	
	SSM symptoms		2.75 (1.63-4.64)
Disability* (SSM function)	FABQ-P-persistent >16	24 (60)	0.53 (0.25-1.15)
	FABQ-P-persistent ≤16	129 (68.6)	
	Duration 3-6mo		1.45 (0.41-5.12)
	Duration 6-12mo		1.94 (0.5-7.44)
	Duration >12mo		0.92 (0.31-2.76)
	EQ5D sum score		1.02 (0.99-1.04)
	SSM symptoms		0.81 (0.45-1.46)
	SSM function		4.05 (2.19-7.48)

*: measured at baseline; CI: confidence interval; Duration: duration of symptoms; FABQ-P: Fear Avoidance Beliefs Physical Activity Subscale; SSM; Spinal Stenosis Measure

*Confounders included when a variable changed the effect between FAB and each outcome by > +/- 10% from the preselected potential confounders: age, gender, low education, civil status, presence of comorbidities, BMI, HADS anxiety score ≥8, HADS depression score ≥8, duration of complaints <3 months, 3-6 months, 6-12 months, or >12 months, baseline SSM symptoms, baseline SSM function, and baseline EQ-5D sum score.

**: raw data