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Original Article

Symptom recurrence and associated factors in postoperative patients with lumbar degenerative disease

Satomi Matsushima, RPT, MS[1, 2)*], Shuntaro Tsuchida, MD[1)], Tomoya Muta, MD[3)], Jyunichi Yamashita, RPT, PhD[3)], Ko Onoda, RPT, PhD[4)], Takayoshi Saito, RPT, PhD[4)], Yukari Horimoto, RPT, PhD[4)]

[1)] *Fuji Toranomon Orthopaedic Hospital: 1067-1 Kawashimata, Gotemba, Shizuoka 412-0045, Japan*
[2)] *Department of Physical Therapy, Graduate School of Health Sciences, International University of Health and Welfare, Japan*
[3)] *JA-Shizuoka Kosei Rehabilitation Nakaizu Onsen Hospital, Japan*
[4)] *Department of Physical Therapy, School of Health Sciences at Fukuoka, International University of Health and Welfare, Japan*

Abstract. [Purpose] This study aimed to examine gradual changes in and relationships among preoperative and 3-month postoperative endpoints in patients with lumbar degenerative disease. [Participants and Methods] The study included 160 diagnosed with lumbar degenerative diseases who underwent surgery. Patients were divided into two groups: "good progress" and "recrudescence". Changes in the Japan Orthpedics Associations (JOA) score, JOA back pain evaluation questionnaire (JOABPEQ), and numeric rating scale (NRS) preoperatively and 3 months postoperatively, and their associations, were analyzed. [Results] Differences were found in preoperative NRS for low back pain, JOA score (other findings) at 3 months postoperatively, and NRS for low back pain at 3 months postoperatively. The causal analysis yielded paths for "daily life", "pain", and "social/psychological aspects", starting with "lumbar spine disorders". [Conclusion] The subjective symptoms, objective findings, lumbar spine dysfunction, gait dysfunction, and numbness at 3 months postoperatively yielded relevant information regarding the participants activities of daily living, pain, and social and psychological aspects, providing a perspective for monitoring postoperative patients.

Key words: Lumbar degenerative disease, Postoperative physical therapy, Relapse of symptoms

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INTRODUCTION

In addition to static factors (yellow ligament, intervertebral discs, intervertebral joints, and osteophytes) and dynamic factors (posture, movement, and spinal instability), spinal deformities are intricately involved in the development of symptoms of lumbar degenerative diseases[1)]. Typical lumbar degenerative diseases include lumbar canal stenosis and disc herniation.

Patient-oriented evaluation is often used to assess the outcome of lumbar spinal canal stenosis. Although cases of reoperation due to postoperative complications and adjacent intervertebral disease have also been reported, the surgical outcome group is considered better than the conservative treatment group[2)]. The recurrence rate of lumbar disc herniation is higher with longer follow-up periods, ranging from 0.5% to 4.0% at 1 year, 1.6% to 9.6% at 2 years, and 1.5% to 8.5% at five years after surgery[3)].

*Corresponding author. Satomi Matsuhima (E-mail: s14m4star3@yahoo.co.jp)

Although minimally invasive surgery allows patients to get out of bed, out of the hospital, and return to work sooner than with conventional surgery, some reports suggest slightly higher rates of hernia recurrence[4, 5]. Although some reports discuss early reoperation[6, 7], motor function, postoperative quality of life (QOL), and patient-centered outcomes remain unclear.

Poorly performed surgery for residual or recurrent back pain, leg pain, or neurological symptoms in the lower limbs after the initial surgery is referred to as postoperative spinal syndrome[8, 9]. Koshi reported that the main causes of postoperative syndrome in spine surgery are (1) local diagnostic errors, (2) overlooking systemic diseases, (3) inappropriate surgical techniques, (4) surgical complications, (5) recurrence and progression of the disease, (6) psychosocial factors, (7) breakdown of the doctor-patient-family relationship, and (8) unknown causes[10]. However, we did not find any reports in our search on the appropriateness of revision surgery in such cases.

Given this context, this study investigated the trends in symptoms and physical function of postoperative patients with lumbar degenerative disease, whose symptoms were judged to have worsened by physicians before and 3 months after surgery and confirmed the relationship between these factors. The significance of this study lies in the obtained information that could contribute to preventing this phenomenon.

PARTICIPANTS AND METHODS

The study included 160 patients (aged 64.2 ± 15.1 years) diagnosed with lumbar degenerative diseases (lumbar spinal canal stenosis, lumbar disc herniation) who underwent surgery at Seikokai Fuji Toranomon Orthopedic Hospital between April 2021 and March 2022. This was a retrospective study. Surgical proceduresincluded endoscopic discectomy (MED), percutaneous endoscopic discectomy (PED), and lumbar discectomies. The postoperative patients started physiotherapy on the following day, 20–40 minutes per day, with voluntary exercise instructions (stretching and strength training), gait exercises, and activities of daily living exercises.

This study was conducted with the approval of the Ethics Committee of The International University of Health and Welfare (22-Ifh-008) and the Ethics Committee of Seikokai Fuji Toranomon Orthopaedic Surgery Hospital (2022-1), and patient information was handled with the utmost care.

We conducted a retrospective survey of patient information at Seikokai Fuji Toranomon Orthopaedic Hospital. The reoperation group in this study was defined based on a previous study[11], referring to patients who visited the hospital 3 months postoperatively and underwent reoperation due to a decline in activities of daily living (hereafter referred to as “ADL”).

Medical records that were reviewed and used for the study included age, height, weight, body mass index (BMI), surgical procedure, number of surgical elevations, amount of blood loss during surgery, number of hospital days, and number of outpatient physiotherapy sessions. In addition, the Japanese Orthopaedic Association Back Pain Evaluation Questionnaire (JOABPEQ), Japanese Orthopaedic Association Back Pain Evaluation Criteria (JOA score), and the Numerical Rating Scale (NRS), which is a numerical pain rating scale, were used.

The JOA score consists of four groups: subjective symptoms, objective findings, activities of daily living, and bladder function, and is scored on a 29-point scale[12]. In this study, the scores for each group and the total score were used to evaluate JOABPEQ.

JOABPEQ was scored according to the manual[13, 14]. This questionnaire consists of 25 questions on five factors and can assess pain-related disability, lumbar spine dysfunction, social life disability, gait dysfunction, and psychological disability. The score for each factor was calculated on a scale of 0–100, with lower scores indicating more severe symptoms. Lumbago, buttock-leg pain, and numbness were assessed using the NRS.

For the statistical analysis, we first checked the basic statistics of the obtained variables. Then, a comparison was made between the good progression group and the recrudescence group using a t-test if the distribution followed a normal distribution, and a Wilcoxon rank-sum test otherwise.

Graphical modeling (GM)[15] was used to extract factors associated with each endpoint. Factors with moderate or high correlation were surrounded by cliques (ovals). A hypothetical model was obtained by focusing on the assessment items with strong partial correlations.

Subsequently, structural equation modeling (hereafter referred to as SEM) was used to explore the structure among the factors in the hypothetical model, and a comprehensive causal model was constructed[15]. The goodness of fit of this model was determined by the χ^2 (p-value), GFI (very good: >0.95), AGIF (very good: >0.95), CFI (very good: >0.95), and RMSEA (very good: <0.05).

JUSE-StatWorks / V4.0 from JUSE was used for these analyses and the significance level was set at 5%.

RESULTS

Of the 160 patients who underwent surgery in the study, 148 were in the good progression group and 12 (7.5%) were in the reoperation group. The recurrence rate was 7.5%, and the mean recurrence period was 15.3 months. No significant differences in patient characteristics were observed between the good and reoperation groups (Table 1). Comparisons between the groups showed significant differences in preoperative NRS back pain, 3-month postoperative JOA score, and preoperative and 3-month postoperative NRS back pain (difference between preoperative and 3-month postoperative scores) (Tables 2, 3).

Table 1. Clinical data for patients

	Good progress group	Recrudescence group
Age (years)	61.6 ± 15.2	63.7 ± 13.6
Stature (cm)	160.8 ± 25.6	160.0 ± 7.6
Body weight (kg)	61.2 ± 12.3	57.5 ± 10.3
BMI (kg/m^2)	23.5 ± 3.4	22.3 ± 3.2
Alb	4.0 ± 0.9	4.1 ± 0.3
CK (CPK)	97.7 ± 84.2	99.0 ± 77.8
Lumbar kyphosis angle	30.0 ± 11.3	21.8 ± 7.7
Numbar of operated vertebrae		
1 intervertebral space	131	12
2 intervertebral space	13	
3 intervertebral space	4	
Blood loss (mL)	17.5 ± 21.2	5.8 ± 1.7
Period of hospitalization (day)	10.2 ± 7.7	7.8 ± 3.5

Average ± standard deviation. **p<0.01, *p<0.05.
BMI: body mass index; Alb: albumin; CK: creatine kinase.

Table 2. Scores for the JOA score, JOABPEQ, and NRS

		Pre-operative		3-month post-operative	
		Good progress group	Recrudescence group	Good progress group	Recrudescence group
JOA score	Subjective symptom	4.2 ± 1.7	3.1 ± 1.8	7.2 ± 1.7	6.3 ± 0.8
	Objective finding	3.7 ± 1.1	3.7 ± 0.9	5.3 ± 0.9*	4.8 ± 1.1*
	Restriction of daily living	7.8 ± 3.1	7.9 ± 3.3	12.6 ± 2.8	11.5 ± 1.6
	Bladder function	−1.0 ± 1.5	−1.3 ± 1.9	−1.3 ± 1.3	−0.8 ± 1.3
	Total score	14.7 ± 5.2	13.4 ± 5.9	22.3 ± 5.6	21.9 ± 3.3
JOABPEQ	Low back pain	58.3 ± 34.3	46.3 ± 27.9	90.4 ± 70.1	95.2 ± 10.8
	Lumbar function	57.5 ± 64.6	46.3 ± 27.9	86.0 ± 21.7	83.3 ± 10.7
	Walking ability	38.3 ± 28.4	38.1 ± 22.4	83.5 ± 26.3	79.8 ± 24.2
	Social life function	55.8 ± 23.4	45.9 ± 18.9	83.6 ± 21.2	72.1 ± 20.7
	Mental health	53.7 ± 17.0	50.7 ± 19.0	71.5 ± 16.3	64.4 ± 17.1
NRS	Lumbago	5.6 ± 2.7**	7.3 ± 0.8**	1.4 ± 2.1	2.1 ± 1.0
	Buttock-leg pain	6.6 ± 2.2	7.2 ± 1.5	1.8 ± 2.3	1.9 ± 1.7
	Numbness	6.3 ± 2.8	6.5 ± 2.6	1.5 ± 2.4	3.2 ± 1.5

Average ± standard deviation. **p<0.01, *p<0.05.
JOA: Japanese Orthopaedic Association; JOABPEQ: Japanese Orthopaedic Association back pain evaluation questionnaire; NRS: numerical rating scale.

Using GM, we analyzed the relationship between the preoperative physical status and each of the postoperative assessment items, obtaining hypothesized model (Fig. 1). The hypothetical model consisted of five factors: F1: lumbar spine disorders; F2: daily life; F3: social and psychological aspects; F4: pain; and F5: preoperative height and weight. The goodness of fit of the model was GIF=0.912, AGIF=0.878, NFI=0.905, and SRMR=0.061.

Next, a path diagram was created to explore the structure of the factors (Fig. 2), An overall causal model was created with four of the five factors, except for F5 (preoperative height and weight), which had a low correlation (Fig. 2). The goodness of fit for this model was p=0.001, GFI=0.862, AGIF=0.830, CFI=0.950, NFI=0.927, and RMSEA=0.056.

DISCUSSION

Kulkarni et al.[16] reported a recurrence rate of 1.6% after MED with an average recurrence period of 22 months. Saejima et al.[6] reported a 4.7% recurrence rate after MED. In the reoperation group, PED was more common than MED and patients were discharged the day after surgery with a mean hospital stay of 7.5 ± 3.5 days. This trend supports a report[4] that early discharge and return to work increase the recurrence rate. Physical therapists should consider treatment programs for recurrence prevention, considering the possibility of an increased recurrence rate after an early return to the hospital. Furthermore,

Table 3. Amount of change in each endpoint pre-operative and 3-month post-operative

		Good progress group	Recrudescence group
JOA score	Subjective symptom	3.3 ± 2.1	3.3 ± 2.2
	Objective finding	1.8 ± 1.4	1.2 ± 1.4
	Restriction of daily living	4.1 ± 3.5	3.6 ± 3.6
	Bladder function	0.2 ± 1.4	0.5 ± 2.1
	Total score	9.4 ± 6.5	8.5 ± 7.3
JOABPEQ	Low back pain	50.6 ± 78.2	48.9 ± 29.3
	Lumbar function	25.7 ± 66.2	22.8 ± 30.7
	Walking ability	47.1 ± 33.2	46.7 ± 36.1
	Social life function	37.1 ± 28.4	26.2 ± 24.0
	Mental health	21.0 ± 17.2	13.8 ± 17.0
NRS	Lumbago	−4.0 ± 2.9**	−5.3 ± 1.0**
	Buttock-leg pain	−5.3 ± 3.1	−5.3 ± 2.8
	Numbness	−4.2 ± 3.4	−3.3 ± 2.7

Average ± Standard deviation. **p<0.01, *p<0.05.
JOA: Japanese Orthopaedic Association; JOABPEQ: Japanese Orthopaedic Association back pain evaluation questionnaire; NRS: numerical rating scale.

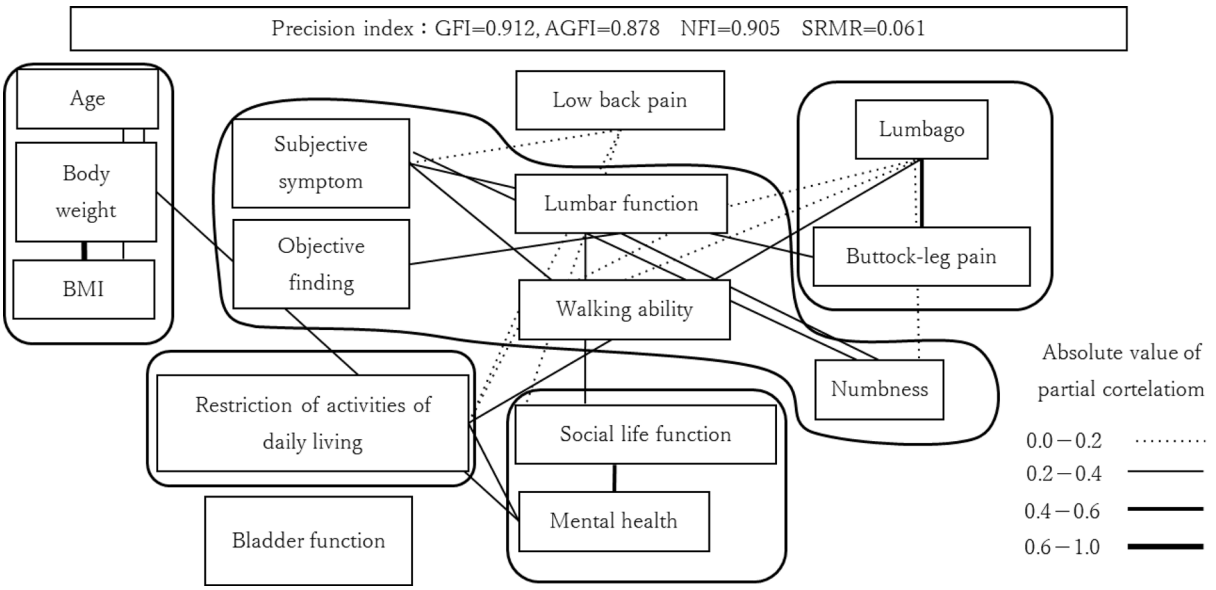

Fig. 1. Independent graphs using GM.
GM: graphical modeling; GFI: goodness of fit index; AGFI: adjusted goodness of fit index; NFI; normed fit index; SRMR: standardized root mean square residual; BMI: body mass index.

considering a report[17] suggesting that aggressive postoperative physical therapy intervention is effective for an early return to work, we believe that it is desirable to implement the intervention intensively.

In the pain evaluation of the good progress and recrudescence groups, preoperative lumbar pain increased, while the amount of change between preoperative and three months postoperatively showed a decrease. In particular, the recrudescence group experienced more pain. These patients had less postoperative lumbar pain than those in the good postoperative group, which may be a reason for their hyperactivity after discharge from the hospital. In addition, the JOA score three months postoperatively was significantly lower in the recrudescence group. The presence of reoperation cases, even those with low JOA scores at three months postoperatively, is an important clue for postoperative management. Easy predictability of increased activity can be based on the disappearance or alleviation of postoperative symptoms. Therefore, patients should be encouraged to undergo periodic examinations and evaluations to assess their abilities and discomfort in activities of daily living, even if they have no other subjective symptoms.

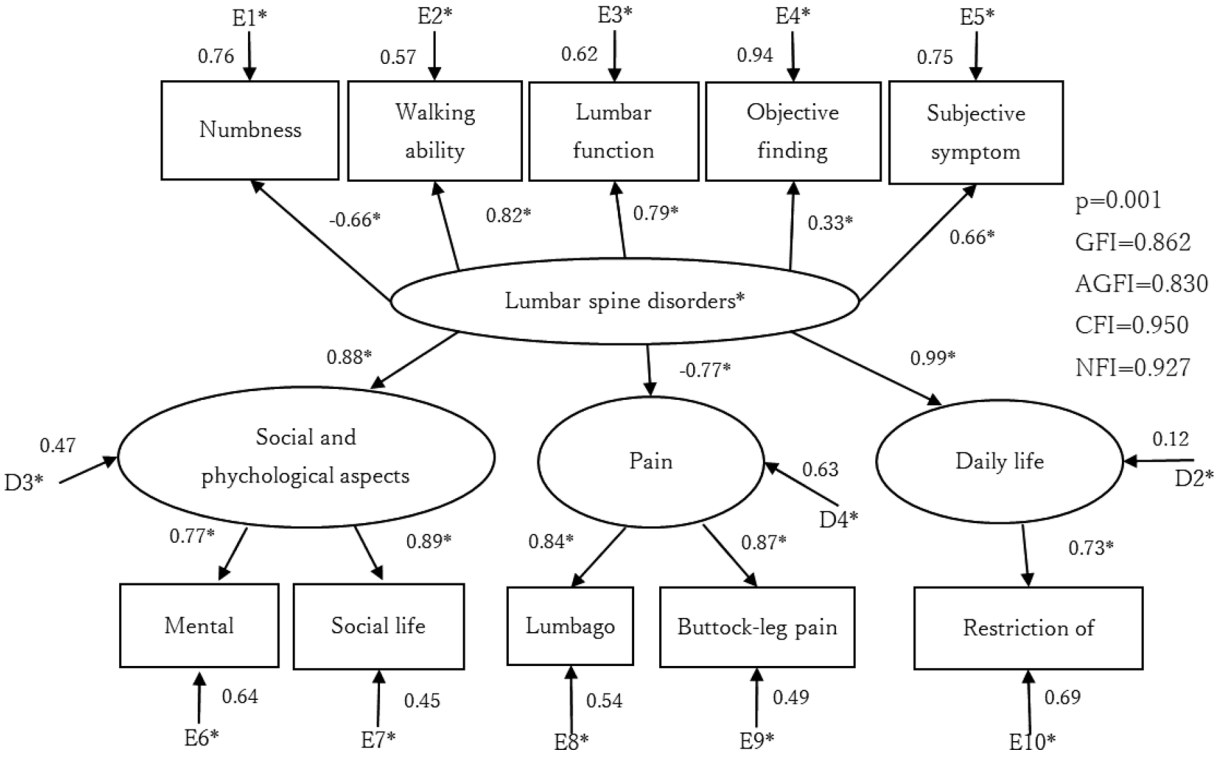

Fig. 2. Comprehensive SEM.
SEM: structural equation modeling; E: error in observed; D: latent variable; GFI: goodness of fit index; AGFI: adjusted goodness of fit index; CFI: comparative fit index; NFI: normed fit index.

A positive SLR test four months postoperatively indicates a risk of recurrence, whereas a negative test indicates good progress, as reported previously[18]. This also indicates for postoperative physical therapy. Furthermore, if muscle weakness is observed in the JOA score, it is necessary to suggest training methods before muscle weakness interferes with activities of daily living. The results of this study provide evidence for the prevention of postoperative recurrence based on the characteristics of patients.

The model for each endpoint at three months postoperatively indicated that F1: lumbar spine disorders; F2: daily life; F3: social and psychological aspects; and F4: pain, were important perspectives. The psychological aspect is particularly important, as previous studies by the authors[19] have shown that catastrophic thinking about pain is associated with pain intensity and level of disability, and it is critical to ask patients whether they perceive their pain experience negatively.

A limitation of this study is its reliance on clinical records from our institution; therefore studies from other institutions are needed before we can say that this trend is generalizable. Additionally, the study included 12 cases of reoperation for lumbar disc herniation, warranting further examination involving recurrence of other degenerative diseases of the lumbar spine as well as biases in surgeons and surgical techniques due to the study conducted at our institution.

Risk factors for the recurrence of degenerative disc herniation in the lumbar spine are reported to be male, young age, high BMI, smoking status, and heavy labor[20]. In this study, no significant differences were found in preoperative patient attributes. This may be due to the small number of patients in the recrudescence group; further investigation is required.

This study concluded that the presence of back pain at three months postoperatively should not be overlooked because of the possibility of recurrence or relapse. Even with a significant improvement compared to the preoperative period, the patient should be evaluated over time for at least three to six months after surgery, focusing on activities of daily living, pain, social and psychological aspects, and paying attention to hyperactivity. From the viewpoint of prevention, when neurological findings or muscle weakness is observed, it is important to make suggestions for improvement before the patients' daily activities are affected.

Conflicts of interest

The authors have no conflicts of interest to declare.

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