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ORIGINAL RESEARCH

Sex Differences in the Mediating Effect of Kinesiophobia on Chronic Pain, Dysesthesia, and Health-Related Quality of Life in Japanese Individuals Aged 65 Years Old and Older Treated with Surgery for Lumbar Spinal Stenosis

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Purpose: This study aimed to determine whether kinesiophobia mediates the relationship between low back pain (LBP), leg pain (LP), and leg dysesthesia (LD) and health-related quality of life (HRQOL) among Japanese individuals aged 65 years old and older treated with surgery for lumbar spinal stenosis (LSS).

Patients and Methods: Data collection for this study took place between October 2019 and August 2020 at two Japanese medical facilities. Eligibility criteria for participants in this study were individuals aged 65 years or older and those who had undergone surgery for LSS at least more than one year ago. A self-administered questionnaire assessed the intensity of LBP, LP, and LD (numerical rating scale: NRS), HRQOL (EuroQol-5 Dimension-5 Levels: EQ-5D-5L), and kinesiophobia (Tampa Scale for Kinesiophobia-17 items: TSK-17). Mediation analysis using sex as a control variable was conducted.

Results: Complete responses were obtained from 238 of 431 individuals (73.1 ± 5.1 years; 135 males and 103 females). The mediating effect of NRS scores for LBP, LP, and LD to EQ-5D-5L index on TSK-17 score was significant, respectively (LBP: −0.007 [95% confidence interval −0.012, −0.004], p = 0.000; LP and LD: −0.007 [−0.011, −0.004], p = 0.000). The strength of the association between NRS scores and EQ-5D-5L index decreased when the mediating effect of TSK-17 score (LBP: β = −0.698 [−0.792, −0.603], p = 0.000 to β = −0.616 [−0.707, −0.524], p = 0.000; LP: β = −0.629 [−0.729, −0.529], p = 0.000 to β = −0.539 [−0.638, −0.440], p = 0.000; LD: β = −0.568 [−0.675, −0.460], p = 0.000 to β = −0.482 [−0.586, −0.378], p = 0.000). The mediating effect of TSK score was greater in females than males.

Conclusion: Kinophobia partially mediated the relationship between LBP, LP and LD, and HRQOL in Japanese aged 65 years and older after lumbar surgery. The mediating effect differed by sex.

Keywords: pain, kinesiophobia, health-related quality of life, sex differences, lumbar spinal stenosis

Introduction

Lumbar spinal stenosis (LSS) is one of the more frequently diagnosed conditions in people over the age of 65 years,[1] as its prevalence increases from 20.0% in those under 40 years of age to 47.2% in those 60–69 years of age.[2] Surgery for LSS is often indicated in people over 65 years of age,[3] but approximately 30% of patients are reported to have leg pain (LP) or dysesthesia, which is an unpleasant abnormal sensation, 2 years postoperatively,[4] and 23% of LSS patients are reported to require medication to control pain or dysesthesia 21 months postoperatively.[5] The health-related quality of life (HRQOL) of individuals over 65 years of age undergoing lumbar surgery is poorer in those with pain than in those without pain.[6] Consequently, measures are needed to improve the HRQOL in this population group.

In addition to pain, the perception of pain, eg, kinesiophobia, also plays a role in the health status of an individual as expressed by the fear-avoidance model (FAM) model.[7] Strong kinesiophobia has been reported to be associated with severe pain and low HRQOL.[8–10] In addition, kinesiophobia is a mediating variable between pain and disability, that is, pain influences disability via kinesiophobia.[11,12] Our study hypothesis was that kinesiophobia mediates the relationship between pain, dysesthesia, and HRQOL, even in people over 65 years of age after lumbar surgery.

Mediation analysis, which uses multiple regression analysis, has been used to prove the mediation effect of kinesiophobia.[11,13] Control variables can be added to the mediation analysis. It was preferred to include sex into the mediation model as a control variable in this study, because there exist sex differences for pain intensity[12] and psychological and cognitive factors,[14,15] and also in the association between kinesiophobia and low back pain (LBP)[16] and motor function.[17] Mediation analysis with sex as a control variable may contribute to a better understanding of the relationship between kinesiophobia and pain, dysesthesia, and HRQOL. Hence, the purpose of this study was to determine whether kinesiophobia acts as a mediating variable between chronic pain, dysesthesia, and HRQOL in individuals over 65 years of age that underwent surgery for LSS over a year ago, and whether the mediating effect of kinesiophobia, if present, differs by sex through mediation analysis. We postulated that if kinesiophobia mediates between pain and dysesthesia and HRQOL in people over 65 years of age after lumbar spine surgery, this study will contribute to strengthening the clinical implications of a kinesiophobia-focused approach.

Materials and Methods
Research Design and Ethical Considerations
This was a cross-sectional observational study that utilized a questionnaire survey. Questionnaires were mailed between October 2019 and August 2020. The study was an extension of a previously published study[18] and approved by the Ethical Review Committees of Sapporo Maruyama Orthopedic Hospital and Harunaso Hospital (approval numbers: 000025 and 190105, respectively). The study was conducted in accordance with the Declaration of Helsinki of 1975, as revised in 1983.

In addition to the questionnaire, we mailed the research description, consent form for research participation, and consent withdrawal form to the participants. The questionnaire required the respondents to provide their names to facilitate matching the questionnaire with the medical records of the hospitals. The intention to participate in the study was confirmed via the consent form. As stated in the research description, the research data were deleted if a withdrawal form was submitted even after completion of the questionnaire.

Participants
The sample size for the mediation analysis, which is desirable for any effect size, was 250 or more, according to simulations by Lachowicz et al.[19] The completion and response rates were estimated at 85% and 70%, respectively; thus, the number of questionnaires sent out was set at 420 or more.

The participants were selected according to the following criteria: aged 65 years or older, diagnosed with LSS and lumbar disc herniation or degenerative slipped lumbar spine at Sapporo Maruyama Orthopedic Hospital and Harunaso Hospital, and had undergone surgery from December 2015 to August 2019, at least more than one year ago. Certified spine surgeons diagnosed the patient's condition based on clinical and radiological findings. In this study, LSS was defined as "any type of narrowing of the spinal canal, nerve root canals [or tunnels], or intervertebral foramina", as defined by Arnoldi et al.[20] Herniated disc and spondylolisthesis of the lumbar spine were considered as subtypes of LSS. We mailed the questionnaire to 431 older adults, excluding five whose addresses were unknown at the time of the survey and one who had passed away.

Items of Investigation
Clinical Demographic Information
Information concerning age, sex, and surgical method were examined from participants' medical records. The days after surgery were defined as the number of days from the date of surgery to the date of response to the questionnaire. Surgical procedures were classified into two categories: decompression only and decompression with fixation.

1846

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Pain and Dysesthesia

The intensities of LBP, LP, and leg dysesthesia (LD), which persisted after surgery, were investigated using an 11-point numerical rating scale (NRS), where 0 points was defined as "no pain (dysesthesia)" and 10 points as "intolerable pain (dysesthesia)." The participants reported the average intensity of their pain/dysesthesia over the previous month. The validity of NRS as a scale for assessing intensity of pain and dysesthesia has already been confirmed.[21,22]

HRQOL

The EuroQol-5 Dimension-5 Levels (EQ-5D-5L),[23] a self-rated assessment tool, was used to evaluate HRQOL. The use of EQ-5D-5L has been validated in stroke[24] and hip/knee osteoarthritis.[25] The EQ-5D-5L consists of five questions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) with five levels of responses for each question. For the domains of mobility, self-care, and usual activities, the difficulties in walking, dressing and washing oneself, and work, housework, and family/leisure activities are graded (from no problem to unable). For the pain/discomfort and anxiety/depression domains, they are graded by degree (none to extremely). The EQ-5D-5L index value was determined by the combination of the responses to each of the five questions. The EQ-5D-5L index value ranged from 0 to 1, with 0 representing "a state as bad as being dead" and 1 representing "full health".[26]

Kinesiophobia

Seventeen items version of the Tampa Scale for Kinesiophobia (TSK-17) was developed by Miller et al[27] and translated into Japanese in 2013.[28] It consists of 17 items. For example, the first item is, "I'm afraid that I might injure myself if I exercise", and the second item is, "If I were to try to overcome it, my pain would increase." Four options, from "strongly disagree (1 point)" to "strongly agree (4 points)", are provided for each question. The TSK-17 score is the sum of the 17 item scores and ranges from 17 to 68 points. Higher scores represent stronger kinesiophobia. The internal consistency and convergent validity of the Japanese version of TSK-17 have already been confirmed.[29]

Statistical Analysis

The investigated parameters were statistically analyzed for the different sexes using the Welch test, followed by a mediation analysis. The explanatory variables were the NRS score for LBP, LP, and LD. Three models were created with LBP, LP, and LD, each, as explanatory variables, because intensity of back pain, lower extremity pain, and dysesthesia is not always consistent with preoperative status or postoperative course.[22,30] The objective variable was the EQ-5D-5L index, the mediator variable was the TSK-17 score, and the control variable was sex (0: male, 1: female). The mediation analysis procedure was divided into the following four steps based on a previous study (Figure 1).[11,13]

Step 1 was the confirmation of the significance of the path from explanatory variables to the objective variable (pass C). A multiple regression analysis was conducted to include the explanatory variables as NRS scores of LBP (model A), LP (model B), and LD (model C), sex and the interaction term (NRS scores and sex), and the objective variable as EQ-5D-5L index.

Step 2 was the confirmation of the significance of the path from the explanatory variables to the mediating variable (pass A). A multiple regression analysis was conducted with the explanatory variables as NRS scores, sex, and interaction terms, and the objective variable was the TSK-17 score.

Step 3 was the confirmation of the significance of the path from the mediating variable to the objective variable when controlled for explanatory variables (pass B), and the decrease in the strength of the path from the explanatory variable to the objective variable when controlled for mediating variables (pass C'). Multiple regression analysis was conducted with NRS scores, TSK-17 score, sex, and two interaction terms (NRS scores and sex, TSK-17 score, and sex) as explanatory variables and EQ-5D-5L index as the objective variable.

A simple slope test was added as a post hoc test if a significant interaction was observed in Steps 1 to 3. The simple slope test is used to evaluate the effect of the interaction by substituting the values obtained by adding and subtracting one standard deviation (SD) of the variables with which there was an interaction.[31]

Step 4 was the estimation of indirect effects (Pass a*b). The bootstrap method[32] was used to estimate the indirect effect, and the 95% confidence interval was calculated. The sample size for the bootstrap method was 5000. The sample generation method was nonparametric. The bias correction method was used for estimating the confidence interval. The
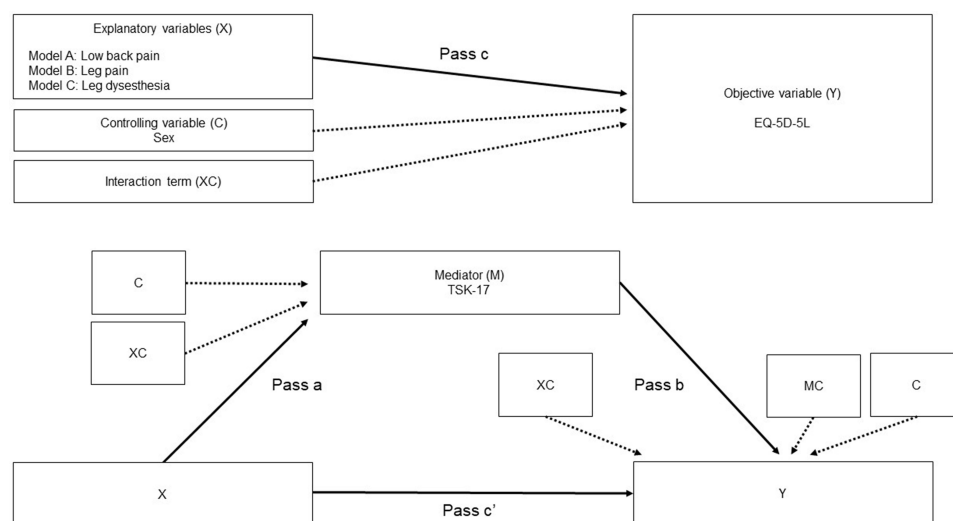
Figure 1 Three mediation models including sex, which is the control variable.
**Abbreviations**: EQ-5D-5L, EuroQol-5 Dimension-5 Levels; TSK-17, Tampa Scale for Kinesiophobia-17 items version; XC, Interaction term between pain; dysesthesia, and sex; MC, interaction term between TSK-17 and sex.

explanatory variables were centered in all multiple regression analyses to avoid multicollinearity. HAD version 17[33] was used for all analyses, and the statistical significance level was set at a risk rate of 5%.

Results

Participant Characteristics

Of the 431 people who were mailed the questionnaire, 322 (74.7%) responded, among whom 249 (57.8%) completed all items. Six individuals who had undergone another spinal surgery, four individuals who had undergone surgery or complained of severe pain in the lower extremity joints, and one individual with severe rheumatoid arthritis were excluded, resulting in the analysis of 238 individuals (55.2%) (73.1 ± 5.1 [65–91] years; 135 male, 103 female; 735.6 ± 317.9 [380–1531] days; 73 for decompression only, 165 for decompression with fixation) (Figure 2). Table 1 summarizes the comorbidities of the study participants.
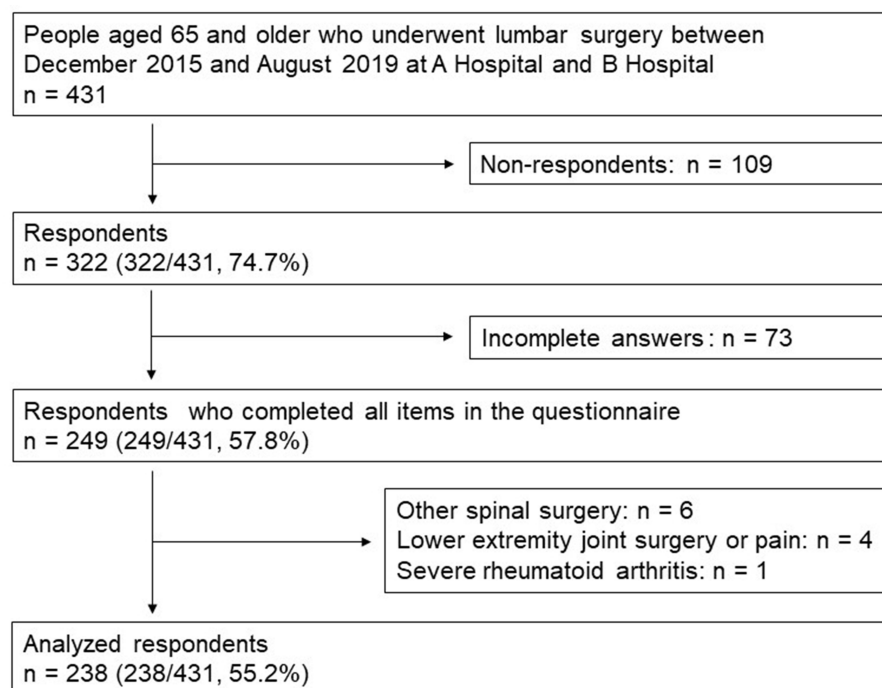
Figure 2 Flowchart of participant selection.

Table 1 Comorbidities of the Study Participants

Items	Males n = 135	Females n = 103
Hypertension	22	13
Diabetes	14	4
Dyslipidemia	5	3
Postoperative cancer	2	2
Respiratory disease (asthma, chronic obstructive pulmonary disease)	3	1
Endocrine disease (Hashimoto's disease, Graves' disease, etc.)	2	1
Cardiac disease (angina pectoris, arrhythmia, etc.)	7	
Ophthalmic disease (cataracts, green cataracts)	5	
Shoulder pain		2
Incomplete kidney	1	
Autonomic ataxia	1	
Cerebral infarction (no sequelae)		1

Comparison of the Parametric Values Between the Sexes

Comparison of the parametric values between the sexes is summarized in Table 2. LBP, LP, and LD did not differ significantly between the sexes (LBP: t(192.05) = −0.900, p = 0.369; LP: t(204.53) = −1.342, p = 0.181; LD: t(196.62) = −1.210, p = 0.228). However, the EQ-5D-5L scores were significantly lower and the TSK-17 scores were significantly higher for female participants than that for the male participants (EQ-5D-5L: t(217.47) = 2.468, p = 0.014; TSK-17: t (233.92) = −2.175, p = 0.031).

Mediating Effect of TSK-17 in the Three Models

In all models of LBP, LP, and LD, a significant negative association with EQ-5D-5L and a significant positive association with TSK-17 were identified in Step 1 and Step 2, respectively (EQ-5D-5L: β = −0.698 [95% confidence interval −0.792, −0.603], p = 0.000, β = −0.629 [−0.729, −0.529], p = 0.000, and β = −0.568 [−0.675, −0.460], p = 0.000, for models of LBP, LP, and LD, respectively; TSK-17: β = 0.293 [0.167, 0.418], p = 0.000, β = 0.321 [0.198, 0.443], p = 0.000, and β = 0.290 [0.165, 0.414], p = 0.000, for models of LBP, LP, and LD, respectively). In Step 3, we conducted a multiple regression analysis by adding TSK-17 to LBP, LP, and LD and found that TSK-17 was independently associated to EQ-5D-5L in all LBP, LP, and LD models (β = −0.289 [−0.381, −0.197], p = 0.000, β = −0.293 [−0.393, −0.192], p = 0.000, β = −0.331 [−0.435, −0.288], p = 0.000, respectively). Furthermore, given the association of TSK-17 with EQ-5D-5L, the strength of the association of LBP, LP, and LD with EQ-5D-5L decreased, but the association remained significant (β = −0.698 [−0.792, −0.603], p = 0.000 to β = −0.616 [−0.707, −0.524], p = 0.000, β = −0.629 [−0.729, −0.529], p = 0.000 to β = −0.539 [−0.638, −0.440], p = 0.000, β = −0.568 [−0.675, −0.460], p = 0.000, β = −0.482 [−0.586, −0.378], p = 0.000, for models of LBP, LP, and LD, respectively) (Table 3). The indirect effects (mediating effects of TSK-17 between LBP, LP, and LD to EQ-5D-5L) were significant in all three models (−.007 [−0. 012, −0. 004], −0.007 [−0.011, −0. 004, −0.007 [−0. 011, −0. 004], respectively]). Therefore, partial mediation models of TSK-17 were established through a series of analyses.

Table 2 Comparison of the Parametric Values Between the Sexes

	All n = 238	Males n = 135	Females n = 103	t-value	df	p value
LBP	2.0 ± 2.0[0–10]	1.9 ± 1.8[0–7]	2.1 ± 2.3[0–10]	−0.900	192.05	0.369
LP	1.9 ± 2.0[0–8]	1.7 ± 2.1[0–7]	2.1 ± 2.4[0–8]	−1.342	204.53	0.181
LD	2.0 ± 2.5[0–9]	1.9 ± 2.3[0–9]	2.3 ± 2.7[0–9]	−1.210	196.62	0.228
EQ-5D-5L	0.75 ± 0.17[0.01–1.00]	0.77 ± 0.17[0.43–1.00]	0.72 ± 0.17[0.01–1.00]	2.468	217.47	0.014[a]
TSK-17	39.7 ± 6.1[23–59]	39.0 ± 6.5[23–59]	40.7 ± 5.4[29–59]	−2.175	233.92	0.031[a]

Notes: [a]p < 0.05. Values are presented as the mean ± standard deviation [range]. The p-values were calculated using the Welch test.
Abbreviations: LBP, low back pain; LP, leg pain; LD, leg dysesthesia; EQ-5D-5L, EuroQol-5 Dimension-5 Levels; TSK-17, Tampa Scale for Kinesiophobia-17 items version.

Table 3 Standardized Partial Regression Coefficients for EQ-5D-5L at the Third Step of Mediation Analysis

Explanatory Variables	Standardized Partial Regression Coefficient [95% Confidence Interval]	p-value
Model 1: Low back pain		
Low back pain	−0.616 [−0.707, −0.524]	0.000
TSK-17	−0.289 [−0.381, −0.197]	0.000
Sex	−0.082 [−0.169, 0.004]	0.063
Low back pain * Sex	0.153 [0.061, 0.245]	0.001
TSK-17 * Sex	−0.066 [0.061, 0.245]	0.156
Model 2: Leg pain		
Leg pain	−0.539 [−0.638, −0.440]	0.000
TSK-17	−0.293 [−0.393, −0.192]	0.000
Sex	−0.071 [−0.165, 0.023]	0.139
Leg pain * Sex	0.107 [0.009, 0.206]	0.033
TSK-17 * Sex	−0.079 [−0.178, 0.020]	0.119
Model 3: Leg dysesthesia		
Leg dysesthesia	−0.482 [−0.586, −0.378]	0.000
TSK-17	−0.331 [−0.435, −0.228]	0.000
Sex	−0.073 [−0.171, 0.026]	0.146
Leg dysesthesia * Sex	0.087 [−0.016, 0.190]	0.096
TSK-17 * Sex	−0.097 [−0.200, 0.005]	0.063

Note: n = 238.
Abbreviations: EQ-5D-5L, EuroQol-5 Dimension-5 Levels; TSK-17, Tampa Scale for Kinesiophobia-17 items version.

In Step 2, though not significant, sex tended to be positively associated with TSK-17 (LBP: $\beta = 0.120$ [−0.002, 0.242], p = 0.055; LP: $\beta = 0.110$ [−0.012, 0.231], p = 0.076; LD: $\beta = 0.116$ [−0.006, 0.238], p = 0.063), regardless of LBP, LP, and LD. There was no significant interaction between LBP ($\beta = 0.035$ [−0.160, 0.090], p = 0.585), LP ($\beta = 0.049$ [−0.171, 0.073], p = 0.430), and LD ($\beta = 0.108$ [−0.232, 0.016], p = 0.088) and sex. In addition, sex was not significantly associated with EQ-5D-5L (LBP: $\beta = −0.082$ [−0.169, 0.004], p = 0.063; LP: $\beta = −0.071$ [−0.165, 0.023], p = 139; LD: $\beta = −0.073$ [−0.171, 0.026], p = 0.146), regardless of LBP, LP, or LD. However, the interactions between LBP and sex ($\beta = 0.153$ [0.061, 0.245], p = 0.001) and LP and sex ($\beta = 0. 107$ [0.009, 0.206], p = 0.033) were significant (Table 3). According to the simple slope test, the model with +1 SD (this model corresponds to females) showed weaker associations of LBP and LP with EQ-5D-5L than the model with −1 SD (this model corresponds to males), resulting in relatively stronger associations of TSK-17 with EQ-5D-5L (Figure 3).
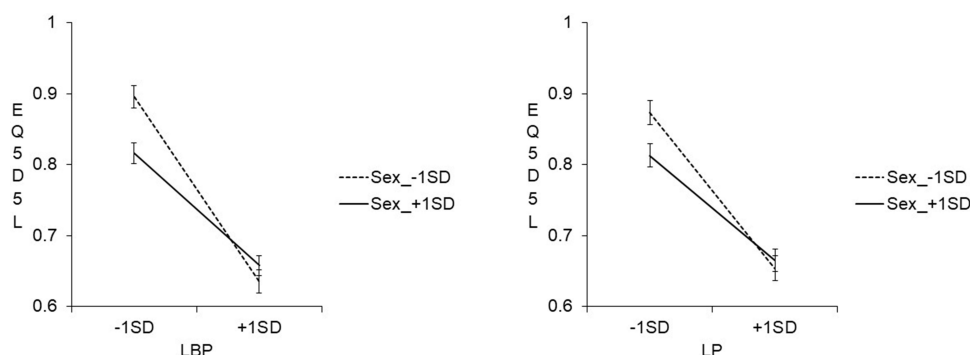
Figure 3 Interaction between low back pain and sex in Model 1 (simple slope test).
Notes: n = 238. Sex was assigned values that were subtracted by one SD in the −1 SD models; the model suggests males. Sex was assigned values plus one standard deviation in the +1 SD model; the model suggests females.
Abbreviations: EQ-5D-5L, EuroQol-5 Dimension-5 Levels; LBP, Low back pain; LP, leg pain; SD, standard deviation.

Discussion

The purpose of this study was to determine whether kinesiophobia acts as a mediating variable in the association between chronic pain/dysesthesia and HRQOL in Japanese individuals aged 65 years and older undergoing surgery for LSS and whether sex affects the relationship between chronic pain/dysesthesia, kinesiophobia, and HRQOL.

Sex Differences in Pain and Dysesthesia, Kinesiophobia, and HRQOL

There were no significant sex differences in the intensity of LBP, LP, and LD in Japanese individuals aged 65 years and older undergoing back surgery. In the Introduction, it was mentioned that the prevalence and intensity of chronic pain is higher among females than among males,[14] but other reports have stated that there is no such difference.[34] The lack of significant findings in this study could be because the intensity of pain and dysesthesia persisting for over a year after surgery for LSS was weaker than that in other studies on postoperative pain,[35,36] which resulted in a small difference in scores between men and women and no statistically detectable difference. Gerbershagen et al[37] conducted a similar study. Considering the findings of this study in light of those of previous studies, there is a need to conduct additional research by subgrouping people with chronic pain based on pain type, background disease, and time period.

The intensity of LBP, LP, and LD in Japanese individuals aged 65 years and older undergoing back surgery in this study was weak, but the EQ-5D-5L index was lower than those reported for the general older population in Hong Kong.[38] In particular, the HRQOL of women was lower than that of men. Laghousi et al[39] found that female survivors of colorectal cancer had a lower HRQOL than males, which they attributed to their lower tolerance for physical and emotional stress. In addition, in a comprehensive review of sex differences in chronic pain, it was noted that women reported lower activities of daily living and higher levels of anxiety than men,[40] both of which are components of the EQ-5D-5L, the HRQOL scale used in this study. Additionally, the association between kinesiophobia and anxiety has been shown in patients undergoing cardiac rehabilitation,[41] which may explain why kinesiophobia was also stronger in women with high anxiety tendencies.

Kinesiophobia as a Mediator Between Chronic Pain, Dysesthesia, and HRQOL

The relationship between kinesiophobia and pain or HRQOL has been previously demonstrated.[8–10] The present study showed a pattern of strong LBP, LP, and LD leading to strong kinesiophobia, and furthermore, strong kinesiophobia leading to low HRQOL using mediation analysis. The result reinforces the validity of the FAM and the transactional model proposed by Lazarus et al,[42] a model wherein the stress response is not directly attributed to the cause of stress; rather, the stress response occurs through cognitive processing of the cause of stress, including coping strategies. Kinesiophobia may be a significant factor that can explain HRQOL in people with pain and dysesthesia regardless of health state or age because kinesiophobia was a mediator in not only people with obesity and whiplash injury but also in individuals aged 65 years and older that underwent lumbar surgery. Pain perception such as catastrophizing[43] and pain self-efficacy[44] as well as kinesiophobia have been reported to mediate the relationship between pain and psychosomatic states. It is not clear whether these concepts of pain perception measures overlap or differ. Further research is needed to examine how the experience of pain is cognitively processed.

The mediated pathway from pain and dysesthesia to HRQOL via kinesiophobia was significant, and the direct path from pain and dysesthesia to HRQOL remained significant, indicating that the three models examined in this study were partial mediation models. Therefore, both the intensity of pain and dysesthesia, and kinesiophobia and dysesthesia are involved in determining HRQOL. Systematic reviews have identified kinesiophobia and pain as determinants of quality of life in people with chronic low back pain,[45] supporting the fact that the direct effect of LBP, LP and LD on HRQOL remained significant in this study.

Effect of Sex on the Mediation Model of Kinesiophobia

In all three models examined, there was no significant interaction between pain/dysesthesia and sex in the path from pain and dysesthesia to kinesiophobia. However, regardless of the intensity of pain and dysesthesia, females' kinesiophobia tended to be consistently stronger than that of males, although there was no significant effect of sex alone. It has been

reported that females tend to be more anxious than males and that this anxiety increases pain sensitivity.[46] As an extension of this finding, in a comparative study by La Touche et al,[47] in which people with chronic LBP were divided into two groups according to their self-efficacy, the group with low self-efficacy had a higher proportion of females as well as higher levels of kinesiophobia and catastrophizing than the group with high self-efficacy. This finding is consistent with the framework that catastrophizing is a cause of kinesiophobia.[48] Therefore, the negative association of females with kinesiophobia in this study may be an indication that females are more likely to perceive pain irrationally than males and, consequently, have a higher degree of kinesiophobia.

There was a significant interaction between LBP, LP, and sex in the path from pain to HRQOL. As a result of the simple slope test, the standardized partial regression coefficients for LBP and LP after controlling for the effect of kinesiophobia were lower in the model with the sex variable one SD higher (this model corresponded to females) than in the model with the sex variable one SD lower (this model corresponded to males). These findings indicate that the association between pain intensity and HRQOL was reduced, and the association of kinesiophobia was relatively stronger in females than in males. Thus, the results demonstrate the strength of the influence of psychosocial factors on HRQOL in females. Since bio-psycho-social factors are dynamically related to chronic pain,[46] it is not surprising that the relative influence of pain intensity and cognition of pain on HRQOL changes in the context of sex.

In addition, females with LBP or LP tended to have a lower HRQOL than males. It has been reported that mental health is associated with social participation (participation in neighborhood associations, sports, hobby groups, etc.) among older Japanese females only.[49] A study in Turkey,[50] a country with a patriarchal culture, comparing females with developmental hip dysplasia who underwent total hip arthroplasty with those who declined the surgery, found significant improvements in HRQOL, particularly in social functioning and mental health after surgery. These reports suggest that even if the intensity of pain is low in females, their HRQOL may be reduced when pain or problems associated with pain limit their performance of societal roles, including homemaking.

Strengths and Limitations of This Study

This study showed that kinesiophobia, an aspect of pain perception, as well as the intensity of persistent postoperative pain and dysesthesia, independently influences HRQOL in older Japanese adults undergoing back surgery, suggesting that an approach that takes the influence of psychosocial and biological factors in chronic pain into account[44] may be effective in older Japanese adults undergoing back surgery. Furthermore, it is important to note that the relationship between pain and dysesthesia, kinesiophobia, and HRQOL was found to differ by sex in the mediation models, signifying the need to develop approaches to improve HRQOL in males and females.

However, three major limitations of this study must be considered. This was a cross-sectional observational study, and the causal relationships assumed in this study were based on previous findings. To obtain strong evidence of causal relationships, longitudinal data are needed. In addition, the findings of this study were obtained from data collected two years ago from only two hospitals in Japan, on individuals aged 65 years or older who underwent lumbar surgery. It is difficult to generalize the findings of this study to the current global population over 65 years of age, and follow-up studies in various population groups are needed to confirm the stability of the findings of this study. Lastly, kinesiophobia is an aspect of the cognitive appraisal of pain and catastrophizing,[43,51] while self-efficacy[44,52,53] is representative of cognitive appraisals other than kinesiophobia. It is important to examine the relationship between these cognitive factors to clarify the process of cognitive appraisals of pain and dysesthesia.

Conclusions

This study demonstrated that kinesiophobia partially mediated the relationship between pain and dysesthesia and health-related quality of life among Japanese individuals aged 65 years and older who had undergone surgery for lumbar spinal stenosis more than one year ago. Furthermore, low back pain, leg pain, and dysesthesia had a greater impact on HRQOL in males, whereas kinesiophobia had a greater impact in females. The need to develop different approaches after lumbar spine surgery for males and females is suggested.

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Disclosure

The authors report no conflicts of interest in this work.

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