The Journal of Physical Therapy Science

S P T S

Original Article

Effects of pain-related catastrophic thinking, anxiety, and depression on pain intensity and quality of life in patients with knee and low back pain

Yuki Kishikawa, RPT, MD, PhD[1)]*, Shinichi Tanaka, RPT, MD[1, 2)], Kenshi Iwanaga, RPT[3)], Ikusei Nakagawa, RPT[3)], Takayuki Shiotsuka, RPT[3)], Nanae Tsuda, RPT[3)], Yusuke Kobachi, RPT[3)], Kosuke Hirano, RPT[3)], Yoji Murakami, MD[3)]

[1)] Department of Rehabilitation Sciences, Faculty of Rehabilitation Sciences, Nishikyushu University: 4490-9 Osaki, Kanzaki, Saga 842-8585, Japan
[2)] School of Rehabilitation, Faculty of Physical Therapy, Reiwa Health Sciences University, Japan
[3)] Murakami Orthopedic Sports Clinic, Japan

Abstract. [Purpose] We aimed to examine the effects of pain-related catastrophic thoughts and anxiety/depression on pain intensity and quality of life (QOL), and how these effects (relationships) vary with pain location, in outpatients with chronic pain. [Participants and Methods] We recruited 14 participants with low back pain (2 males and 12 females) and 14 with knee joint pain (3 males and 11 females). We used the following evaluation tools: the visual analog scale (to evaluate pain intensity), pain catastrophizing scale (in which scores are categorized into helplessness, rumination, and magnification), Hospital Anxiety and Depression Scale (for psychodynamic evaluation), and a questionnaire for QOL evaluation. [Results] There was no difference in pain intensity between the groups. The "low back pain" group showed a positive correlation between pain intensity and anxiety, while the "knee pain" group showed a positive correlation between pain intensity and helplessness. The "low back pain" group showed a negative correlation between health in QOL assessment items and helplessness, and between health and magnification. However, in the "knee pain" group, there was a negative correlation between health and rumination, between health and anxiety, and between positive mental attitude and magnification. [Conclusion] Mental status varied depending on the pain location, regardless of the intensity of the pain. This suggests that a psychological approach dependent on pain location is needed during physical therapy.
Key words: Chronic pain, Quality of life, Pain psychological characteristics

INTRODUCTION

Low back pain and knee osteoarthritis are representative chronic pain diseases of the musculoskeletal system[1, 2]. Both chronic pain conditions have been reported to have a significant impact on activities of daily living, resulting in a significant reduction in quality of life (QOL) and social loss. The incidence of chronic pain and osteoarthritis is projected to increase in the future[3, 4].

Chronic pain patients often fail to maintain a good QOL because they continue to experience pain on a daily basis. The World Health Organization defined quality of life as "Health is the state of complete physical, mental and social well-being not merely the absence of disease or infirmity" in 1947. In Japan, there are 22 million patients with chronic pain, and the

social loss is said to be 1,953 billion yen in 2012[5]), and countermeasures are required. Japan's Chronic Pain Treatment Guideline stated QOL improvement as a treatment goal, and team medicine aimed at improving the ability to perform activities for an active social life was being developed in 2018[6]). Among factors associated with QOL, pain and psychological aspects are subjective observations and they significantly impact physical functioning and social aspects[7]). Psychological aspects are thought to be factors that intensify pain, and one of these factors is catastrophic thinking of pain. This is a pessimistic and overly preoccupied mindset about pain, consisting of "rumination", which is thinking about recurring pain, "helplessness", which is thinking that there is no way to escape pain, and "magnification", which is thinking of pain as a stronger entity than it needs to be[8]). The usefulness of understanding and treating catastrophic thinking has been suggested[9]).

We considered that understanding the differences in psychological factors between chronic low back pain and knee osteoarthritis is a necessary factor for the effective advancement of treatment. Therefore, the purpose of this study was to investigate pain intensity, catastrophic thoughts, anxiety, depression, and QOL in outpatients with chronic pain, and to clarify the relationship between pain intensity, QOL, and psychological aspects caused by pain location.

PARTICIPANTS AND METHODS

Fourteen patients with pain in the low back (2 males and 12 females; low back pain group) and 14 patients with osteoarthritis of the knee (3 males and 11 females; knee pain group) with pain in the knee joint were randomly selected from patients attending the clinic.

The purpose and content of the study were communicated to the participants orally and in writing, that personal information would be handled with the utmost care in accordance with the Declaration of Helsinki, and that they were free to participate in the study and would not be disadvantaged by not participating. Informed consent was obtained from all participants in accordance with the guidelines for medical research in the "Ethical Guidelines for Clinical Research" of the Ministry of Health, Labor, and Welfare. Participants were excluded from the study if they were expected to be in the acute phase of a partial meniscectomy or knee joint replacement surgery immediately before the study.

As an assessment of pain, the Visual Analogue Scale (VAS) was based on self-reported measures of symptoms that were recorded with a single handwritten mark placed at one point along the length of a 100 mm line that represents a continuum between the two ends of the scale "no pain" on the left end (0 mm) of the scale and the "worst pain" on the right end of the scale (100 mm). Measurements from the starting point (left end) of the scale to the patients' marks were recorded in millimeters and were interpreted as their pain intensity[10]).

The Japanese version of the Pain Catastrophizing Scale (PCS) was used for the psychometric evaluation. The PCS has been reported to be a highly reliable and valid instrument[11]). The scale consists of 13 questions answered on a 5-point scale (0=not at all applicable, 1=not very applicable, 2=undecided, 3=somewhat applicable, 4=very applicable), and three subscales can be evaluated: rumination, helplessness, and magnification. In this study, the scores on each scale were used as measurements.

The QOL questionnaire developed by Ota et al.[12]) was used to assess the quality of life. This questionnaire has been proven reliable and valid[12, 13]). The questionnaire is based on Lawton's concept of the QOL[14]) and is divided into six scales: life activity capacity, health, personal support, financial comfort, mental health, and mental vitality, which includes two to five questions for each scale, with all answers to each question using the two-factor method. In this study, the scores for each scale were used as measurements.

The Japanese version of the Hospital Anxiety and Depression Scale (HADS)[15]), an anxiety and depression test developed by Zigmond and Snaith in the UK for general outpatient use, was used to assess anxiety and depression (Table 1). The reliability and validity of this questionnaire have been well documented for reliability and validity[16]). The questionnaire

Table 1. Comparison between the low back and knee pain groups in pain intensity, PCS and HADS

		Low back pain	Knee pain
	Age (years)	58.1 ± 18.7	68.5 ± 9.7
	Height (cm)	159.3 ± 8.4	157.7 ± 7.9
	Weight (kg)	59.6 ± 9.4	61.6 ± 11.5
Pain	VAS (mm)	45.2 ± 21.4	38.6 ± 21.0
PCS	Rumination (points)	12.00 ± 5.14	11.00 ± 6.01
	Magnification (points)	7.79 ± 4.89	6.50 ± 4.20
	Helplessness (points)	6.14 ± 2.21	4.79 ± 3.68
HADS	Anxiety (points)	6.57 ± 2.41	5.71 ± 2.84
	Depression (points)	5.71 ± 2.61	5.86 ± 3.23

PCS: Pain catastrophizing scale; HADS: Hospital anxiety and depression scale; VAS: Visual analogue scale. Unpaired t-test. Mean ± standard deviation.

J. Phys. Ther. Sci. Vol. 34, No. 9, 2022

626

contained 14 items, with seven items each assessing anxiety and depression. Responses to each question were assessed using a four-item method. In this study, the scores on each scale were used as the measurements.

For statistical processing, the Shapiro–Wilk test was used to confirm the probability of significance for the low back pain and knee joint pain (hereafter referred to as "knee pain") groups, and for items for which normality was found, the Levene test was used to confirm equal variance, the t-test without correspondence, and the Pearson's correlation coefficient. The Mann–Whitney U test and Spearman's correlation coefficient were used for items for which normality was not found. IBM SPSS statistics 26 was used for statistical analysis, with a significance level of 5%.

RESULTS

In terms of mean age, the low back pain group was 58.1 ± 18.7 years, and the knee pain group was 68.5 ± 9.7 years, with no significant differences. There were no significant differences between the low back pain and knee pain groups in height, weight, VAS, PCS, HADS and QOL (Tables 1 and 2). In terms of correlation with pain intensity, the low back pain group showed a positive correlation between pain intensity and anxiety (r=0.54) on the HADS, and the knee pain group showed a positive correlation between pain intensity and helplessness (r=0.54) on the PCS (Table 3). We found that the low back pain group showed a negative correlation between health and helplessness (r=−0.57), between health and magnification (r=−0.58), and the knee pain group showed a negative correlation between health and rumination (r=−0.56), between health and anxiety (r=−0.57), and between positive mental attitude and magnification (r=−0.59) (Table 4). Statistical analysis of the correlations was not possible because "daily activity" was 5 points of all patients, and "satisfaction with human support" was 3 points of all patients in the knee pain group (Tables 3, 4).

Table 2. Comparison between the low back pain and knee pain groups in quality of life

QOL	Low back pain	Knee pain
Daily activity (points)	5.00 (0.00)	5.00 (0.00)
Health (points)	2.00 (2.00)	2.50 (1.00)
Human support (points)	3.00 (0.00)	3.00 (0.00)
Economic state (points)	2.00 (0.00)	2.00 (1.00)
Depression (points)	1.00 (2.00)	2.00 (2.00)
Positive mental attitude (points)	3.00 (1.00)	3.00 (1.00)

QOL for knee pain was all 5 for "daily activity" and all 3 for "satisfaction with human support". Mann–Whitney U test.
Median (interquartile range). QOL: quality of life.

Table 3. Correlation coefficient of PCS, HADS and QOL with pain intensity in the low back pain and knee pain groups

		Low back pain r value	Knee pain r value
	Age	−0.181	−0.147
	Weight	0.191	−0.031
PCS	Rumination	0.324	0.512
	Helplessness	0.152	0.537*
	Magnification	0.256	0.452
HADS	Anxiety	0.543*	0.064
	Depression	−0.098	0.363
QOL	Daily activity	−0.204	—
	Health	−0.165	−0.079
	Human support	0.069	—
	Economic state	0.290	0.002
	Depression	0.153	0.122
	Positive mental attitude	0.359	−0.172

Pearson's correlation: age, weight, PCS and HADS.
Spearman's correlation: QOL.
*p<0.05.
QOL: quality of life; PCS: Pain catastrophizing scale; HADS: Hospital anziety and depression scale.

Table 4. Correlation coefficient of PCS and HADS with QOL in the low back pain and knee pain groups

	QOL	PCS			HADS	
		Rumination	Helplessness	Magnification	Anxiety	Depression
Low back pain	Daily activity	−0.201	−0.333	−0.256	−0.155	0.051
	Health	−0.503	−0.568*	−0.576*	−0.250	−0.033
	Human support	0.450	0.448	0.279	0.313	−0.383
	Economic state	0.333	0.240	0.219	0.191	−0.321
	Depression	0.246	−0.221	0.104	−0.316	0.054
	Positive mental attitude	0.396	0.072	0.254	0.235	−0.054
Knee pain	Health	−0.560*	−0.287	−0.440	−0.566*	−0.053
	Economic state	−0.443	−0.243	−0.336	−0.483	0.038
	Depression	−0.372	−0.073	−0.302	−0.311	−0.328
	Positive mental attitude	−0.529	−0.503	−0.589*	−0.228	−0.247

Spearman's correlation. *p<0.05. QOL: quality of life; PCS: Pain catastrophizing scale; HADS: Hospital anxiety and depression scale.

DISCUSSION

This study investigated how pain intensity and psychological disturbances are affected by the location of the pain. Comparing the low back pain and knee pain groups, there were no significant differences in pain intensity, catastrophic thoughts, anxiety and depressive psychological aspects, and values related to the QOL. However, in terms of pain intensity, the low back pain group showed a positive correlation between pain intensity and anxiety, and the knee pain group showed a positive correlation between pain intensity and helplessness. In terms of QOL, the low back pain group showed a negative correlation between health and helplessness, between health and magnification, and the knee pain group was a negative correlation between health and rumination, between health and anxiety, between positive mental attitude and magnification. Thus, we found that there were differences in intentions and psychological aspects caused by the location of the pain, regardless of the intensity of the pain.

Compared to neck pain, back and knee pain has been reported to have a greater impact on an individual QOL[17]. Significantly higher scores have been reported for all PCS items and for anxiety and depression in patients with low back pain than in those without pain[18]. It has also been reported that there is a negative correlation between PCS and QOL in low back pain[19]. In this study, the low back pain group showed a negative correlation between health and helplessness, and between health and magnification, although there was no correlation between health and ruminations. In addition, a previous study of total knee replacement patients showed a strong association between fear avoidance and negative affect in patients with type D personality[20], making them more prone to catastrophic thinking. The knee pain group showed a negative correlation between health and rumination, and between health and anxiety in this study. Thus, it is clear that catastrophizing and anxiety differ depending on the location of pain, which is also reflected in the QOL.

The PCS subscales include "rumination", "helplessness", and "magnification". Previous studies have reported that "rumination" indicates the severity of pain, "helplessness" indicates the degree of life disability, and "magnification" indicates an effect on anxiety[21]. In this study, no group showed a positive correlation between pain intensity and ruminations, suggesting that patients may not perceive the pain as a life-threatening and serious symptom. Pain intensity was correlated with anxiety in the low back pain group and helplessness in the knee pain group in this study. In both the low back and knee pain conditions, chronic pain can be debilitating due to physical dysfunction, leading to a significant reduction in the QOL and substantial social consequences. Physical therapy plays a therapeutic role through exercise, with the goal of improving or maintaining specific health conditions. There is some high-quality evidence that exercise improves pain and function with chronic low back pain and knee osteoarthritis[22, 23]. Based on the findings of this study, the psychological treatments of these pain disorders, which vary according to the location of the pain, may be considered during physical treatment of these pain disorders, thereby improving the usefulness of pain relief. In the present study, there was no correlation between pain intensity and catastrophic thinking in low back pain patients, however, previous studies have found a correlation[24, 25]. Patients who visited the clinic during this study may have been adequately treated for mental health. However, due to the small number of participants in this study, it will be necessary to continue evaluating PCS in the future.

We consider that it important to approach rehabilitation for chronic pain by focusing on the location and degree of pain and clarifying not only the physical functional aspect but also the psychological aspect.

REFERENCES

1) Cimmino MA, Ferrone C, Cutolo M: Epidemiology of chronic musculoskeletal pain. Best Pract Res Clin Rheumatol, 2011, 25: 173–183. [Medline] [CrossRef]

2) Nicolson PJ, Bennell KL, Dobson FL, et al.: Interventions to increase adherence to therapeutic exercise in older adults with low back pain and/or hip/knee osteoarthritis: a systematic review and meta-analysis. Br J Sports Med, 2017, 51: 791–799. [Medline] [CrossRef]

3) Searle A, Spink M, Ho A, et al.: Exercise interventions for the treatment of chronic low back pain: a systematic review and meta-analysis of randomised controlled trials. Clin Rehabil, 2015, 29: 1155–1167. [Medline] [CrossRef]

4) Felson DT, Zhang Y: An update on the epidemiology of knee and hip osteoarthritis with a view to prevention. Arthritis Rheum, 1998, 41: 1343–1355. [Medline] [CrossRef]

5) Inoue S, Kobayashi F, Nishihara M, et al.: Chronic pain in the Japanese community—prevalence, characteristics and impact on quality of life. PLoS One, 2015, 10: e0129262. [Medline] [CrossRef]

6) Noguchi K, Date H, Ushida T: Clinical practice guideline for chronic pain. Tokyo: Shinko Trading Company Ltd, 2018, pp 1–27.

7) World Health Organization: Constitution in basic documents. https://apps.who.int/gb/bd/pdf_files/BD_49th-en.pdf. (Accessed May 6, 2022)

8) Sullivan MJ, Bishop SR, Pivik J: The Pain Catastrophizing Scale: development and validation. Psychol Assess, 1995, 7: 524–532. [CrossRef]

9) Mizuno Y: Chronic pain and catastrophizing. Jpn Psychosom Med, 2010, 50: 1133–1137.

10) Haefeli M, Elfering A: Pain assessment. Eur Spine J, 2006, 15: S17–S24. [Medline] [CrossRef]

11) Matsuoka H, Sakano Y: Assessment of cognitive aspect of pain: development, reliability, and validation of Japanese version of pain catastrophizing scale. Jpn J Psychosom Med, 2007, 47: 95–102.

12) Ohta T, Haga H, Osada H, et al.: [Development and evaluation of a QOL questionnaire for elderly subject living in a community]. Jpn J Public Health, 2001, 48: 258–267 (in Japanese). [Medline]

13) Kishikawa Y, Miyabara H, Komatsu Y, et al.: Validity of QOL rating scale for the elderly in the community. W Kyushu J Rehabil Sci, 2018, 11: 25–27.

14) Lawton MP: The concept and measurement of quality of life in the frail elderly: a multidimensional view of quality of life in frail elders. Cambridge: Academic Press, 1991, pp 3–27.

15) Zigmond AS, Snaith RP: The hospital anxiety and depression scale. Acta Psychiatr Scand, 1983, 67: 361–370. [Medline] [CrossRef]

16) Hatta H, Higashi A, Yashiro H, et al.: Validation of the Hospital Anxiety and Depression Scale. Jpn J Psychosom Med, 1998, 38: 309–315.

17) Kumagai G, Wada K, Kudo H, et al.: The effect of low back pain and BMC. Musculoskelet Disord, 2021, 22: 14.

18) Elden H, Gutke A, Kjellby-Wendt G, et al.: Predictors and consequences of long-term pregnancy-related pelvic girdle pain: a longitudinal follow-up study. BMC Musculoskelet Disord, 2016, 17: 276. [Medline] [CrossRef]

19) Bansal D, Gudala K, Lavudiya S, et al.: Translation, adaptation, and validation of the Hindi version of the pain catastrophizing scale in patients with chronic low back pain for use in India. Pain Med, 2016, 17: 1848–1858. [Medline] [CrossRef]

20) Vogel M, Riediger C, Krippl M, et al.: Negative affect, type D personality, quality of life, and dysfunctional outcomes of total knee arthroplasty. Pain Res Manag, 2019, 2019: 6393101. [Medline] [CrossRef]

21) Sullivan MJ, Lynch ME, Clark AJ: Dimensions of catastrophic thinking associated with pain experience and disability in patients with neuropathic pain conditions. Pain, 2005, 113: 310–315. [Medline] [CrossRef]

22) van Dillen LR, Lanier VM, Steger-May K, et al.: Effect of motor skill training in functional activities vs strength and flexibility exercise on function in people with chronic low back pain: a randomized clinical trial. JAMA Neurol, 2021, 78: 385–395. [Medline] [CrossRef]

23) Fransen M, McConnell S, Harmer AR, et al.: Exercise for osteoarthritis of the knee. Cochrane Database Syst Rev, 2015, 1: CD004376. [Medline]

24) Yap JC, Lau J, Chen PP, et al.: Validation of the Chinese Pain Catastrophizing Scale (HK-PCS) in patients with chronic pain. Pain Med, 2008, 9: 186–195. [Medline] [CrossRef]

25) Meyer K, Sprott H, Mannion AF: Cross-cultural adaptation, reliability, and validity of the German version of the Pain Catastrophizing Scale. J Psychosom Res, 2008, 64: 469–478. [Medline] [CrossRef]