

Relationship Between Pain Intensity, Pain Catastrophizing, Self-efficacy in Patients With a Frozen Shoulder

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Abstract

Background: The evaluation of pain catastrophizing and self-efficacy is useful for predicting pain and is also associated with shoulder pain. The purposes of our study were to examine the relationship between pain catastrophizing, self-efficacy, and pain intensity in patients with a frozen shoulder.

Methods: Ninety-three patients who were diagnosed with frozen shoulder were included in this study. Pain intensity (Numerical Rating Scale: NRS), pain catastrophizing (Pain Catastrophizing Scale: PCS), and self-efficacy (Pain Self-Efficacy Questionnaire: PSEQ) were measured at the first examination, and the relationship was examined using Bayesian estimation method. We developed a hypothesis model in which self-efficacy affects pain catastrophizing and pain catastrophizing affects pain intensity.

Results:

The path coefficients from the PSEQ score to the PCS score and from the PCS score to the NRS score were significant. The convergence of the hypothesized model was confirmed and validated (posterior prediction p-value 0.35).

Conclusion: Our results suggest that self-efficacy affects pain catastrophizing, and pain catastrophizing affects pain intensity.

Introduction

Chronic pain negatively impacts activities of daily living (ADL) and health-related quality of life (QOL). It has been reported that shoulder pain can be recurrent and frequently progresses to the chronic stage[1]. To treat chronic pain, it is important to control acute pain. Melzack et al. [2] suggested that pain can be interpreted from sensory aspects such as the intensity and location of the pain, emotional aspects, e.g., fear and anxiety, and cognitive aspects, e.g., pain catastrophizing. For example, it has been reported pain catastrophizing has been associated with increased fear avoidance behaviours, pain intensity and disability[3]. Besides, Henderson et al. [4] reported that during pain, catastrophic thinking has a significant impact on activity in motor and sensory integrative regions. These results suggest that the emotional aspect of pain may be as important as the sensory aspect of pain.

Psychological factors that have been researched in terms of their relationship with pain were mainly emotional aspects, such as depression and anxiety. We have reported that the evaluation of pain catastrophizing, which is a negative thought associated with pain, is useful for predicting pain in upper limb musculoskeletal disorders [5]. Pain catastrophizing is the concept of irrational and negative predictions about future events. Sullivan et al. [6] defined pain catastrophizing as exaggerated negative thoughts about pain stimulation. In addition, it has been reported that self-efficacy should be considered as one of the cognitive aspects of pain in the chronic pain model [4]. Bandura [8] defined self-efficacy as a recognition of action execution to produce the desired outcome in certain situations. It has been reported that cognitive strategies for such pain cause shoulder pain [9]. Therefore, it is important

that interventions in pain catastrophizing and self-efficacy are necessary. However, the relationship between pain catastrophizing, self-efficacy, and pain has not been studied, and it is not clear how interventions in these areas have affected the improvement of pain.

The purposes of our study were to examine the relationship between pain catastrophizing, self-efficacy, and pain intensity in patients with a frozen shoulder. We hypothesized that self-efficacy affects pain catastrophizing, and pain catastrophizing affects pain intensity.

Methods

Ethical considerations

This cross-sectional study was conducted with approval of the local ethics review board (approval number: 16-48). The content and purposes of the study were explained in advance to the patients, and consent to participate in this study was obtained from the prospective patients. This investigation was conducted according to the principles expressed in the Declaration of Helsinki.

Patients

We enrolled 93 patients who were diagnosed with frozen shoulder and started rehabilitation on any day from January 2016 until March 2017. Patients who had calcium deposits or rotator cuff injuries, fractures, required surgery, work-related injuries or injuries due to accidents, bilateral disorders, apparent dementia were excluded. The content and purpose of the study was explained in advance to these patients, and consent to participate in this study was obtained from prospective subjects.

Outcome measures

Pain was evaluated in all patients at the first examination. In order to control the measurement bias, same physical therapists performed all evaluations for each subject. In addition, the answer of the questionnaire, only the patient was performed.

Pain intensity was determined using the Numerical Rating Scale (NRS) [10]. The NRS is a common scale for quantifying pain and is assessed using an 11-point Likert-type scale (0=no pain; 10=worst pain). The scale was used to record the average pain intensity.

Pain catastrophizing was determined using the Japanese version of the Pain Catastrophizing Scale (PCS) [11]. The PCS is a 13-item self-report questionnaire that measures maladaptive thoughts regarding pain. Each item is rated on a 5-point Likert-type scale (0=not at all; 4=all the time). The PCS contains three dimensions of pain catastrophizing. Higher scores reflect a greater degree of pain catastrophizing. Rumination is paying too much attention to pain-related thoughts. Helplessness is to feel helpless in dealing with a painful situation. Magnification is an overview of the threat of pain.

Self-efficacy was assessed using the Japanese version of the Pain Self-Efficacy Questionnaire (PSEQ) [12]. The PSEQ is a 10-item self-report questionnaire that measures the degree of self-confidence in performing an activity in a painful state. Each item is rated on a 7-point Likert-type scale (0=not at all confident; 6=completely confident). Higher scores reflect stronger self-efficacy beliefs.

Statistical analysis

Covariance structure analysis was performed using the hypothesized model. Previous studies [13-15] have reported that there is no correlation between self-efficacy and pain intensity, and there is a correlation between self-efficacy and pain catastrophizing, pain catastrophizing, and pain intensity. Based on these reports, we developed a hypothesis model in which self-efficacy affects pain catastrophizing and pain catastrophizing affects pain intensity (Figure 1). Bayesian estimation implemented via Markov Chain Monte Carlo simulation was used for the estimation method. The Bayesian estimation method is one of the estimation methods in structural equation modeling, and is a method that can estimate the true value or a value close to it even with a complicated model, data that is not normally distributed, or an under sample size. The reason for adopting the Bayesian estimation method in this study is that there is a concern that the distribution of the data may not be stable because the sample size is small and the data is an ordinal scale. The estimation values are presented as median; the chain number was 5, and the number of simulations ranged from 10,000 to 50,000. The convergence of the model determined that the potential scale reduction would be less than 1.1. The posterior prediction p-value was referenced for model fit.

Mplus, version 8.0 (Muthen & Muthen, <http://www.statmodel.com/>) was used to perform the statistical analyses. The significance level was set at $P < 0.05$. Individuals with missing values were excluded from the specific outcome measure analysis.

Results

Relationship between the cognitive and sensory aspects of pain

Patient characteristics are shown in Table 1. The convergence of the hypothesized model was confirmed and validated (posterior prediction p-value 0.35). Hence, Figure 2 was adopted as the final model. The path coefficients from the PSEQ score to the PCS score and from the PCS score to the NRS score were -0.55 and 0.39, respectively, and these values were significant ($p < 0.05$).

Table 1. Characteristics and Scores for each measurement item of the study patients (n=93)

gender (n)	
men	31
women	62
age (years)	61.6 ± 12.2
disease duration (week)	13.5 ± 15.0
NRS	7.0 (5.5- 7.5)
PCS	
Total score	19.0 (14.5- 27.0)
Rumination	5.0 (4.0- 8.5)
Helplessness	10.0 (6.5- 13.0)
Magnification	4.0 (2.5- 5.5)
PSEQ	46.0 (35.0- 53.0)

mean ± standard deviation, median (interquartile range)

Discussion

Previous studies [9,16,17] have reported that it is important to improve pain catastrophizing and self-efficacy to reduce pain intensity, but these relationships have not been clarified. However, the results of this study show that pain catastrophizing directly affects pain intensity, and self-efficacy indirectly affects pain intensity through pain catastrophizing in patients with a frozen shoulder. The relationship between pain catastrophizing and pain intensity has been studied from various perspectives, including physiological and neurological perspectives. Lazarus and Folkman [18] advocated a cognitive appraisal theory that stress is caused not by stressors, but by interpretation and response to stressors. Severijns et al. [19] interpreted pain catastrophizing as a cognitive scheme. It is considered that it is a problem that the pain is not a problem, and the person with a high pain catastrophizing experiences the pain excessively and interprets it as not being able to cope. These cognitive schemes enhance pain intensity and pain behavior in order to draw help from others [20]. The fear avoidance model [21] explains that avoiding activities that can cause pain because of pain catastrophizing or becoming sensitive to pain can cause disuse, depression, and further pain. Therefore, it is important to promote behavior change by

improving pain catastrophizing, but our data suggest that it is important to improve self-efficacy for that purpose.

People with low PSEQ score think that they cannot do anything because of pain. Therefore, it is important to change the idea that various activities can be carried out even if there is pain in order to improve pain catastrophizing. The dimension of generality is assumed in self-efficacy [7]. Individuals who think that it is possible to do movement even if there is pain do not think of pain as a threat, think of pain as something that can be dealt with, and generalize it into pain catastrophizing. We think that it is important not only for therapists to provide treatment but also for therapists to be involved so that patients can actively participate in their rehabilitation.

There are several limitations to this study. First, the use of a cross sectional design prevents any causal inferences. Second, the relationship between pain and psychological factors has been studied in a variety of disorders, but similar results may not be obtained for all conditions generating pain. This study only assessed outcomes for individuals experiencing shoulder pain, so generalizations to other locations should be done with prudence. Third, the only relationships investigated in this study were pain catastrophizing, self-efficacy, and pain intensity. In addition, various factors related to pain, such as depression and fear, have been reported [22,23]. In the future, we think that the relationship of pain will become clearer by examining factors other than those verified in this study.

Our results suggest that self-efficacy affects pain catastrophizing, and pain catastrophizing affects pain intensity in patients with a frozen shoulder.

Abbreviations

NRS: Numerical Rating Scale; PCS: Pain Catastrophizing Scale; PSEQ: Pain Self-Efficacy Questionnaire

Declarations

Ethics approval and consent to participate

This study was conducted with the approval of the appropriate Ethics Review Committee, Kawasaki University of Medical Welfare (approval number: 16-48). The content and purposes of the study were explained in advance to the patients, and consent to participate in this study was obtained from the prospective patients. This investigation was conducted according to the principles expressed in the Declaration of Helsinki.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used in the current study are not publicly available due to privacy protection.

Competing interests

The authors declare that they have no competing interests.

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None.

Authors' contributions

Hirata, Koike and Yoshimura participated in the design, analysis, and interpretation of results and drafting the manuscript. Inoue participated in revision of the manuscript for important intellectual content. Tomiyama participated in acquisition of data, interpretation of results, and revision of the manuscript for important intellectual content. All authors read and approved the final manuscript.

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Figures

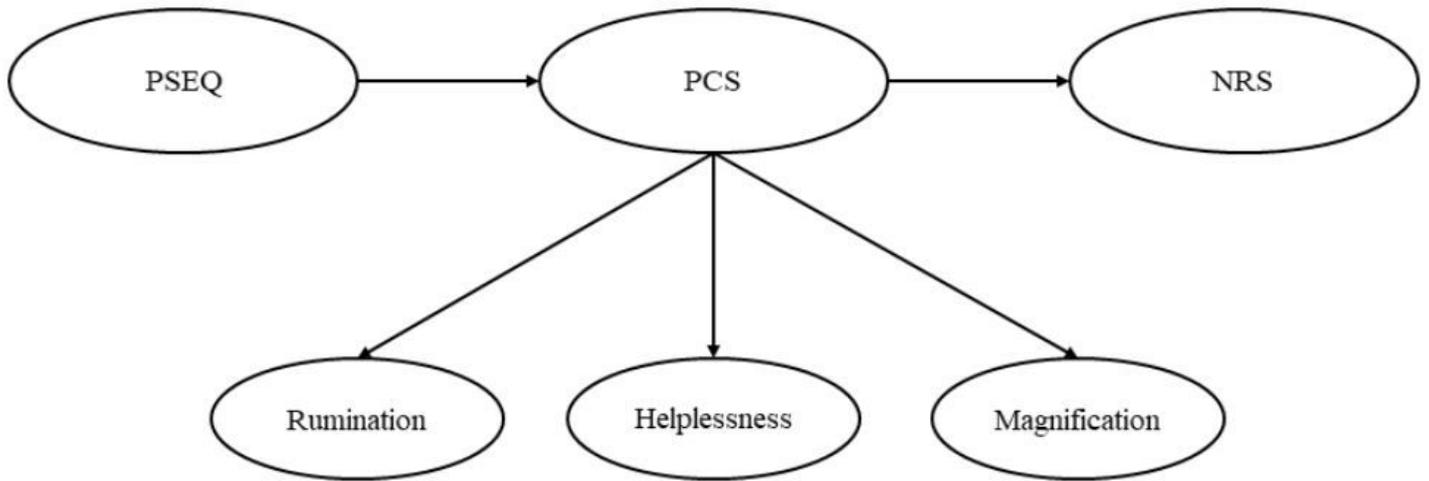


Figure 1

Hypothesized model of pain PCS: Pain Catastrophizing Scale, PSEQ: Pain Self-Efficacy Questionnaire; NRS: Numerical Rating Scale

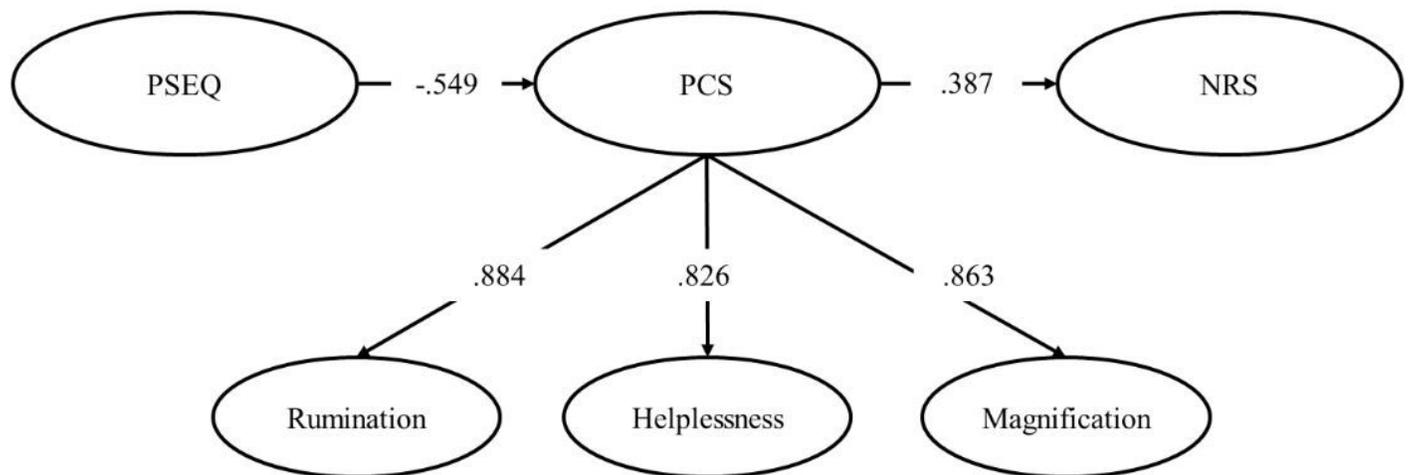


Figure 2

Relationship between the cognitive and sensory aspects of pain potential scale reduction <1.1, posterior prediction p-value 0.57: p<0.05 PCS: Pain Catastrophizing Scale, PSEQ: Pain Self-Efficacy Questionnaire, NRS: Numerical Rating Scale