Mediating Effect of Medical Coping Styles in Patients with Chronic Pain between Pain Degree and Pain Catastrophe

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Abstract: *Objective*: To explore the relationship between pain degree and pain catastrophe and medical coping mode in patients with chronic pain. *Methods*: A visual analogue score scale, medical coping style questionnaire and pain catastrophe scale were used to survey 200 patients in the pain department. *Results*: The average scores of pain degree of patients with chronic pain were (5.97 ± 2.29), the average score of the total score of the Pain Catastrophe Scale was (21.21 ± 11.56), and the average scores of facing, avoidance and surrender in the Medical Response Style Questionnaire were (17.93 ± 3.4), (16.82 ± 2.4), and (8.87 ± 2.83), respectively. Pain degree was positively correlated with the yield dimension in pain catastrophe and medical coping ($p < 0.05$). The yield dimension of medical coping was positively correlated with pain catastrophe ($p < 0.05$). Medical coping methods played a partial mediating role between pain degree and pain catastrophe, and the mediating effect accounted for 21.59% of the total effect. *Conclusion*: The pain level of chronic pain patients can affect the level of pain catastrophe through medical coping, and clinical medical staff should guide patients to adopt positive coping methods to promote their healthy recovery.

Keywords: Chronic pain; Degree of pain; Medical responses; Catastrophic pain; Mediating effects

1. Introduction

Pain, recognized as the fifth vital sign, not only leads to physical functional impairments in patients but also increases their psychological stress, resulting in a series of psychological issues such as anxiety and depression [1]. Chronic pain, however, prolongs the negative effects of pain on patients, exacerbating and catastrophizing the physical and psychological problems caused by pain. According to relevant statistics, Chronic pain affects 20% of the global population, with such patients experiencing more severe physical and psychological issues compared to those with acute pain [2,3]. Currently, clinical interventions such as physical therapy, pharmacological treatment,

and psychotherapy are employed to alleviate pain and reduce pain catastrophizing levels, yet their effectiveness remains limited. However, modifying patients' coping strategies for pain offers a new avenue for reducing pain catastrophizing. In terms of pain coping strategies, negative coping is more likely to exacerbate physical and mental health issues in patients compared to positive coping [4]. Poor coping strategies for chronic pain can lead to pain catastrophizing, yet domestic discussions on this issue remain scarce, and the argument that pain intensity can influence pain catastrophizing through medical coping styles is still unclear [5]. Based on this, this study focuses on the characteristics of clinical patients with chronic pain, clarifies the primary medical coping styles of current chronic pain patients, and their effects on the relationship between pain intensity and pain catastrophizing, in order to provide a theoretical basis for future clinical practice.

2. Objects and methods

2.1. Objects

A convenience sampling method was employed to collect data from patients visiting the Pain Department of a tertiary-grade A hospital in Xi'an from January 2023 to June 2023.

2.1.1. Inclusion criteria

Meeting the diagnostic criteria for chronic pain with a pain state persisting for over three months; aged 18 years or above; possessing certain cognitive reading and communication abilities; informed consent from both patients and their families.

2.1.2. Exclusion criteria

Critically ill patients; patients with mental disorders or other major life-threatening diseases; those who withdrew from the survey midway.

2.2. Sample size

According to Kendall's sample size estimation method, the sample size should be 5 to 10 times the number of variable items [6]. This study included 34 items in total (1 item from the Visual Analog Scale, 20 items from the Medical Coping Modes Questionnaire, and 13 items from the Pain Catastrophizing Scale, totaling 34 items). Taking 5 times the number of items and considering a 10% non-response rate, the minimum calculated sample size was 187 cases, with a final sample size of 200 cases included in this study. This study complies with the requirements of the Declaration of Helsinki.

2.3. Survey methods

All the investigators responsible for this survey underwent unified training before entering the departments to conduct the investigation. The survey was conducted in the form of anonymous face-to-face questionnaires to ensure that the respondents were informed and consented to participate voluntarily in this study. The first page of the questionnaire included an informed consent form, the purpose of the survey, and instructions. The respondents completed the survey under the guidance of the investigators. All questionnaires were distributed and collected on site. A total of 211 questionnaires were distributed, and 200 valid questionnaires were collected, resulting in a response rate of 94.7%.

2.4. Survey tools

(1) A general information questionnaire was designed by the researchers themselves, covering age, gender, marital status, educational level, occupation, payment method, place of residence, cause of pain, and duration of pain.

(2) The Visual Analog Scale (VAS) is the most commonly used single-dimensional pain intensity measurement and assessment tool, widely applied in clinical settings. The scale consists of 10 graduations divided into five levels: "0" indicates no pain, "1–3" indicates mild pain, "4–6" indicates moderate pain, "7–9" indicates severe pain, and "10" indicates excruciating pain. Patients select the appropriate graduation based on their specific feelings to indicate their current level of pain [7].

(3) The Medical Coping Modes Questionnaire (MCMQ) was developed by Feifel and translated and adapted into Chinese by Shen Xiaohong and Jiang Qianjin [8]. It consists of three dimensions: confrontation (8 items, maximum score of 20), avoidance (7 items, maximum score of 25), and resignation (5 items, maximum score of 11), totaling 20 items. Each item is scored on a Likert 4-point scale. Higher scores indicate a greater tendency to use that coping style. The reliability coefficients for each dimension of the scale are 0.64, 0.85, and 0.67, respectively.

(4) The Pain Catastrophizing Scale (PCS) was developed by psychologist Sullivan M [9]. It is concise and easy to administer, consisting of three dimensions: helplessness (H, 6 items), magnification (M, 3 items), and rumination (R, 4 items), totaling 13 items. Each dimension is scored on a Likert 5-point scale. The overall internal consistency of the scale is 0.94, and the reliability coefficients for each dimension are 0.82, 0.8, and 0.79, respectively.

2.5. Statistical analysis

The original data were entered by two individuals using EpiData 3.2. Statistical analysis was performed using SPSS 26.0. For categorical data, frequencies and percentages were used for representation, while for continuous data, the mean ± standard deviation ($\bar{x} \pm s$) was utilized. Correlation analysis was conducted using Pearson correlation analysis for data conforming to a normal distribution. Stepwise linear regression was employed to detect the mediating effect of medical coping styles between pain intensity and pain catastrophizing. The structural equation model was established and the mediating effect was validated using AMOS 24.0 software. A statistically significant difference was considered when $p < 0.05$.

3. Results

3.1. General information

The specific content is shown in **Table 1**.

Table 1. General information of patients

Category	Number (n)	Percentage (%)
Age		
18—60	129	64.5
≥ 61	71	35.5
Gender		
Male	118	59.3

Table 1 (Continued)

Category	Number (n)	Percentage (%)
Female	81	40.7
Marital status		
Unmarried	19	9.5
Married	160	80.0
Divorced	3	1.5
Widowed	18	9.0
Education level		
Primary school or below	23	11.5
Junior high school	71	35.5
High school or technical secondary school	40	20.0
College	23	11.5
Bachelor's degree or above	43	21.5
Occupation		
Employee	15	7.5
Medical staff	20	10.0
Worker	19	9.5
Farmer	69	34.5
Self-Employed	19	9.5
Retired	35	17.5
Other	23	11.5
Payment method		
Public expense	12	6.0
Health insurance	133	66.8
Out-of-pocket	54	27.1
Residence		
Urban	89	44.5
County/Town	31	15.5
Rural	80	40.0
Cause of pain		
Bone/Joint/Spinal pain	121	61.5
Cancer pain	21	10.5
Neuropathic pain	10	5.0
Thrombotic pain	13	6.5
Liver cirrhosis pain	5	2.5
Other	28	14.0

Table 1 (Continued)

Category	Number (n)	Percentage (%)
Duration of pain		
< 1 year	49	24.5
1–5 years	126	63.0
6–10 years	19	9.5
> 10 years	6	3.0

3.2. Scores for pain, medical coping styles, and pain catastrophizing in this group of patients

The visual analog scale score for pain among the study subjects was (5.79 ± 2.29). Among them, the pain scores were as follows: 1–3 points (mild) in 27 patients (13.5%), 4–6 points (moderate) in 103 patients (51.5%), 7–9 points (severe) in 49 patients (24.5%), and 10 points (excruciating) in 21 patients (10.5%). The score for medical coping styles was (45.54 ± 5.77), with scores for each dimension as follows: confrontation (17.93 ± 3.4), avoidance (16.82 ± 2.4), and resignation (8.87 ± 2.83). The total score for pain catastrophizing was (21.21 ± 11.56), with scores for each dimension as follows: helplessness (8.86 ± 5.47), magnification (4.83 ± 3.10), and rumination (7.54 ± 3.97).

3.3. Correlation analysis of pain scores, medical coping styles, and pain catastrophizing in patients with chronic pain

Pairwise analysis of pain scores, medical coping styles, and pain catastrophizing revealed that pain intensity was significantly correlated with the confrontation and resignation dimensions of the Medical Coping Modes Questionnaire (MCMQ) and Pain Catastrophizing Scale (PCS) ($p < 0.05$), demonstrating a significant positive predictive effect. See **Table 2**.

Table 2. Correlation analysis of pain intensity, medical coping styles, and pain catastrophizing in patients with chronic pain (n = 200, r)

Category	Pain catastrophizing	Helplessness	Magnification	Rumination	Medical coping modes	Confrontation	Avoidance	Resignation
Pain catastrophizing	1	-	-	-	-	-	-	-
Helplessness	0.945[b]	1	-	-	-	-	-	-
Magnification	0.908[b]	0.804[b]	1	-	-	-	-	-
Rumination	0.894[b]	0.737[b]	0.752[b]	1	-	-	-	-
Medical coping modes	0.382[b]	0.381[b]	0.371[b]	0.295[b]	1	-	-	-
Confrontation	0.161[a]	0.157[a]	0.154[a]	0.140[a]	0.766[b]	1	-	-
Avoidance	0.094	0.084	0.094	0.076	0.623[b]	0.290b	1	-
Resignation	0.506[b]	0.516[b]	0.493[b]	0.369[b]	0.589[b]	0.115	0.073	1
Pain score	0.374[b]	0.333[b]	0.328[b]	0.381[b]	0.226[b]	0.242[b]	0.030	0.145[a]

Note: [a]$p < 0.05$, [b]$p < 0.01$, "-" indicates repeated data.

3.4. Analysis of the mediating effect of medical coping styles on the relationship between pain scores and pain catastrophizing in patients with chronic pain

The dimensions of confrontation and surrender in the medical coping styles of patients with chronic pain were correlated with pain scores and pain catastrophizing, meeting the prerequisites for a mediating effect. The avoidance dimension in medical coping styles was not correlated with pain intensity or the dimensions of pain catastrophizing, and therefore was not included in the analysis of mediating effects. See **Table 3** for details.

Table 3. Analysis of the mediating effect of medical coping styles (confrontation, surrender) on the relationship between pain scores and pain catastrophizing in patients with chronic pain

Step	Dependent variable	Independent variable	β	SE	F	t	R^2	Adjusted R^2
Step 1	Pain catastrophizing	Pain score	0.37	2.134	32.133	5.67[b]	0.140	0.135
Step 2	Confrontation	Pain score	0.24	0.102	12.333	3.51[a]	0.059	0.054
	Resignation	Pain score	0.15	0.087	4.230	2.02[a]	0.021	0.016
Step 3	Pain catastrophizing	Pain score	0.36	0.342	16.684	5.24[b]	0.145	0.136
		Confrontation	0.07	0.231		1.10		
	Pain catastrophizing	Pain score	0.31	0.293	52.641	5.28[b]	0.348	0.342
		Resignation	0.46	0.237		7.94[b]		

Note: [a]$p < 0.05$, [b]$p < 0.001$.

3.5. Verification of the mediating effect of medical coping styles on the relationship between pain intensity and pain catastrophizing in patients with chronic pain

Using AMOS 24.0 software, a structural equation model was constructed with pain catastrophizing as the dependent variable, surrender in medical coping styles as the mediating variable, and pain intensity as the independent variable, as shown in **Figure 1**. The maximum likelihood method was used for model fitting, and the model was reasonably revised based on the model's modification indices. The revised model fitting results showed that the relative chi-square (CMIF/DF) = 0.639, goodness-of-fit index (GFI) = 0.996, comparative fit index (CFI) = 1.000, adjusted goodness-of-fit index (AGFI) = 0.981, incremental fit index (IFI) = 1.002, and root mean square error of approximation (RMSEA) = 0.000. All fitting indices were within acceptable ranges, indicating a good model fit. The mediating effect was tested using the Bootstrap method. The results revealed that the 95% confidence intervals for both the direct and indirect effects of pain intensity on pain catastrophizing did not include 0. This indicates that surrender plays a partially mediating role between pain intensity and pain catastrophizing, confirming the validity of the model. Consistent with the regression analysis results, the point estimate of the mediating effect was 0.016, accounting for 4% of the total effect, as shown in **Table 4**.
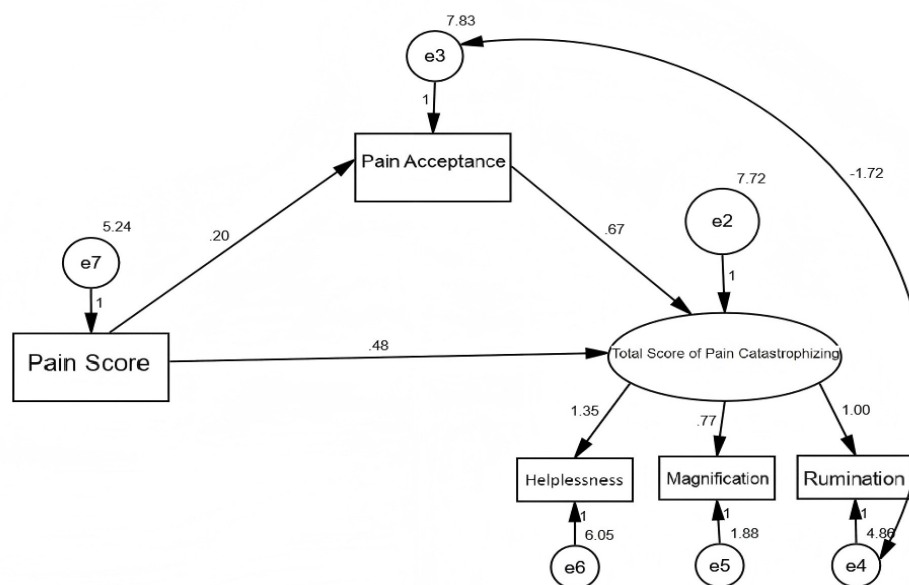
Figure 1. Structural equation model (standardized) of the mediating effect of medical coping styles on the relationship between pain intensity and pain catastrophizing in patients with chronic pain.

Table 4. Bootstrap analysis of path effects

Effect type	Effect value	Standard error	*p-*value	95% CI	Effect proportion
Direct effect	0.306	0.094	< 0.01	0.306–0.674	76.11%
Indirect effect	0.016	0.062	< 0.01	0.016–0.256	4%
Total effect	0.402	0.110	< 0.01	0.402–0.841	-

4. Discussion

4.1. Analysis of pain severity, medical coping styles, and pain catastrophizing in patients with chronic pain

The results of this study indicate that patients scored (5.79 ± 2.29) on the pain scale, indicating a relatively high level of pain. More than half of the patients experienced moderate to severe pain (76.0%), a finding similar to that of Ren Xiaoran's survey [10]. This similarity may be related to the causes of pain, as most patients in this study suffered from bone, joint, and lumbar-shoulder-neck pain (61.5%). Such types of pain are significant contributors to "years lived with disability" (YLDs) globally [11]. They are prone to recurrent episodes, can trigger neuropathic pain, produce radiating pain, and manifest as intense pain during flare-ups, causing indescribable suffering to patients and heightening their perception of pain [3]. Furthermore, chronic pain has long-term adverse effects on patients' lifestyles, physical activities, and psychological well-being, reducing their quality of life, exacerbating the negative impacts of pain, and intensifying their original pain perception [12]. Therefore, most patients with chronic shoulder and neck pain experience severe pain, warranting further exploration of comfortable nursing methods to mitigate the negative effects of pain on patients.

In this study, patients scored (17.93 ± 3.40) on the confrontation dimension of the Medical Coping Modes Questionnaire (MCMQ), (16.82 ± 2.40) on the avoidance dimension, and (8.87 ± 2.83) on the resignation

dimension. These results are similar to those of Li Hongmei's study on patients with cancer pain [13]. The primary coping styles in this study were confrontation and resignation. The reason for this may be that 61.5% of the patients in this study suffered from shoulder, neck, lumbar, back, and joint pain. Although such pain has an acute onset and is intense, advances in medical technology have led to diverse and effective treatment methods for this type of chronic pain. Consequently, symptoms of chronic shoulder, neck, lumbar, back, and joint pain resolve quickly, with short acute pain periods. Therefore, patients have confidence in treatment and can actively confront acute pain episodes of their chronic pain conditions. During the course of disease treatment, patients are required to maintain strict bed rest and immobility, resulting in limitations to their daily lives and a sense of helplessness and resignation [14]. Consequently, they are prone to feelings of resignation, and the accumulation of long-term negative emotions can lead to the development of negative psychological states such as depression and giving up in response to the disease. This suggests that healthcare professionals should pay closer attention to changes in the emotions and coping mechanisms of patients during the acute phase of chronic pain, strengthening both physical and psychological management for patients and providing timely assistance.

The results of this study indicate that the pain catastrophizing score for patients in this group was (21.21 ± 11.56), which is similar to the findings of Xiang Wei's study on orthopedic pain patients and higher than the survey results of Liu Jia's study on patients after total knee arthroplasty [15,16]. The reason for this discrepancy is that the types of pain included in this study were diverse, encompassing severe pain conditions such as cancer pain and trigeminal neuralgia, as well as recurrent pain in areas such as the lower back, neck, and joints. Severe pain is the primary cause of erroneous pain perception, leading to a high incidence of pain catastrophizing (52.3%) [17]. Additionally, pain in the shoulders, neck, and lower back, although not as severe in nature, significantly impacts daily life and, in severe cases, can have long-term effects on physical function, reducing patients' quality of life and leading to excessive rumination and worry about pain.

4.2. Correlation analysis of pain intensity, medical coping styles, and pain catastrophizing

This study reveals that there is a correlation between the pain intensity of patients in this group, their medical coping styles, and pain catastrophizing. Pain intensity is positively correlated with pain catastrophizing ($r = 0.37$, $p < 0.01$), a finding similar to that of Morlion's study, indicating that the higher the pain intensity, the higher the level of pain catastrophizing [18]. The more intense the pain, the greater the psychosocial negative impact on patients, leading to manifestations of pain catastrophizing. The results of this study also show a positive correlation between pain intensity and medical coping styles ($r = 0.23$, $p < 0.01$), consistent with the findings of Zhang Shan's study [19]. The higher the pain intensity, the worse the patient's treatment compliance, the longer the treatment duration, and the more likely the patient is to adopt negative coping strategies. In this group of patients, medical coping styles were positively correlated with pain catastrophizing ($r = 0.38$, $p < 0.01$). This is because patients who adopt negative coping strategies when dealing with chronic pain are more prone to experiencing emotions such as irritability and helplessness, thereby increasing their levels of pain catastrophizing. Meanwhile, some foreign scholars have proposed the Fear-Avoidance Model, which suggests that when patients adopt negative coping strategies, it intensifies their experience of disease-related suffering, exacerbates their perception of pain, and subsequently leads to pain catastrophizing emotions [20]. Therefore, by altering patients' negative attitudes towards pain, the impact of pain severity on emotional distress can be reduced [21].

4.3. Medical coping styles partially mediate the relationship between pain severity and pain catastrophizing

The mediation effect results of this study revealed that pain severity has a positive predictive effect on pain catastrophizing. The level of pain severity can directly predict the degree of pain catastrophizing in patients. Medical coping styles partially mediate the relationship between pain severity and pain catastrophizing. Adopting correct coping strategies can alter catastrophic thinking. The reasons are as follows: Firstly, pain severity can directly influence pain catastrophizing. When pain persists or intensifies, patients with pain are prone to experiencing negative emotions such as anxiety and irritability, leading to an increase in pain catastrophizing levels [22]. Therefore, reducing the pain severity in patients with chronic pain can decrease their levels of pain catastrophizing. Previous studies have shown that methods such as systematic pain nursing management, three-step seven-method massage, and narrative medicine can reduce pain severity. Secondly, pain severity can also indirectly affect pain catastrophizing by influencing medical coping styles. When pain severity increases, patients are more likely to adopt negative coping strategies such as avoidance and submission, which increase the psychological burden of pain-related diseases, amplifying patients' feelings of helplessness and anxiety towards disease pain, thereby elevating pain catastrophizing levels [23]. Conversely, when pain severity is low, patients adopt positive coping strategies, leading to a decrease in pain catastrophizing levels. When pain cannot be alleviated, patients may resort to negative coping strategies and continuously focus on the pain [24]. Adopting negative strategies such as submission reflects the behavioral stress response of chronic pain patients to disease catastrophizing perception, while also indicating a certain degree of pain catastrophizing in patients.

A six-month longitudinal eye-tracking study revealed that shorter attention spans on pain were associated with more positive coping strategies [25]. Healthcare professionals should promptly address patients' negative emotional cognitions and take timely measures to help reduce their levels of pain catastrophizing, thereby improving their quality of life. This can be achieved by formulating reasonable and effective pain catastrophizing management strategies, employing cognitive-behavioral therapy to alter patients' negative perceptions of pain, fostering a correct, positive, and uplifting mindset, enhancing their sense of life's meaning, and reducing pain catastrophizing levels [26–28].

5. Limitations

This study utilized convenience sampling to select research subjects, resulting in a relatively small sample size and potential selection bias. Subsequent research will expand the scope of sample collection and adopt a multi-center approach for further validation. Additionally, this study solely examined the relationships between medical coping styles, pain intensity, and pain catastrophizing in patients experiencing pain, with limited exploration of other influencing factors. Future research will continue to delve deeper, conducting targeted intervention studies on specific diseases to provide more empirical data supporting the mediating effect of medical coping styles on the relationship between pain intensity and pain catastrophizing.

6. Conclusion

In conclusion, the pain intensity in chronic pain patients can influence their level of pain catastrophizing through medical coping styles. Therefore, healthcare professionals should guide patients to adopt more positive coping

strategies to promote recovery.

Disclosure statement

The authors declare no conflict of interest.

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