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ORIGINAL RESEARCH

Latent Profile of Pain Catastrophizing and Its Relationship to Emotional State in Patients with Ureteral Calculi: A Cross-Sectional

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Introduction: Patients with ureteral calculi, especially after undergoing extracorporeal shock wave lithotripsy (ESWL), are particularly prone to pain catastrophizing due to residual stone fragments, discomfort from stents, fear of recurrence, and previous trauma from renal colic. This leads to a vicious cycle where pain and anxiety reinforce each other, significantly magnifying the overall pain experience.

Methods: Using the convenience sampling method, 260 patients with ureteral calculi were selected as research subjects. The General Information Questionnaire, the Pain Catastrophizing Scale (PCS), and the Positive and Negative Affect Scales (PANAS) were administered to the enrolled subjects. The data were then verified through logistic regression analysis and analysis of variance.

Results: The effective recovery rate was 91.54%. The pain catastrophizing of patients with ureteral calculi was divided into three latent profile categories: high, medium, and low pain catastrophizing groups. Significant differences were observed in living arrangements (χ^2=9.998, P=0.007), duration of disease (χ^2=14.540, P=0.006), frequency of pain (χ^2=21.169, P < 0.001), self-rated anxiety (χ^2=17.219, P=0.009), and social support (χ^2=10.612, P=0.009) among the three categories of patients with ureteral calculi. Logistic regression analysis indicated that living arrangements, disease duration, frequency of pain, self-rated anxiety status, and social support are closely related to pain catastrophizing (P < 0.05). Pairwise comparison results showed that the level of positive emotional state in patients of the high pain catastrophizing group was significantly lower than that in the medium pain catastrophizing group (P < 0.01) and significantly lower than that in the low pain catastrophizing group (P < 0.01). Additionally, the level of positive emotional state in patients of the medium pain catastrophizing group was significantly lower than that in the low pain catastrophizing group (P < 0.01).

Conclusion: Pain catastrophizing among patients with ureteral calculi can be categorized into three distinct profiles, which are significantly influenced by factors such as living arrangements, duration of the disease, frequency of pain, self-rated anxiety levels, and social support. These factors are closely linked to the patients' emotional state.

Keywords: ureteral calculi, pain catastrophizing, emotional state, relevance

Introduction

Ureteral calculi are solid substances that descend from the kidneys and become lodged in the ureter, or they may form directly within the ureter itself due to abnormalities such as stenosis or diverticula. These can lead to urinary tract obstruction and associated symptoms.[1] Common symptoms include sudden and severe lower back pain, sharp or colicky pain that often radiates to the ipsilateral lower abdomen, groin, or perineum, along with visible or microscopic blood in the urine, nausea, vomiting, frequent and urgent urination, and painful urination.[2,3] Epidemiological data indicates that

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the global adult lifetime prevalence ranges from 10% to 15%,[4] with an incidence of approximately 5% to 10%[5] in China. Extracorporeal shock wave lithotripsy (ESWL) is currently one of the primary treatments for ureteral calculi.[6]

Pain catastrophizing is a psychological response characterized by excessive negative cognition of pain experiences, where individuals amplify their pain and feel helpless.[7] Patients with ureteral calculi are particularly susceptible to this phenomenon due to post-surgical stimulation from residual stones, discomfort from ureteral stents, fear of disease recurrence, and psychological trauma from acute renal pain experienced before surgery. This could create a vicious cycle of "pain, anxiety, and increased pain".[8] On one hand, pain catastrophizing in patients with ureteral calculi post-surgery can lower the pain threshold, extend the recovery period, and necessitate higher doses of analgesic medication.[9,10] On the other hand, it can lead to anxiety, depression, and other emotional issues. Patients may also avoid necessary follow-up and treatment due to fear of pain, thereby increasing the risk of stone recurrence and complications.[11] Consequently, identifying ureteral calculi patients at high risk for postoperative pain catastrophizing, and implementing relevant preventive and intervention strategies, is crucial for improving their prognosis. An individual's emotional state is their psychological response in a specific situation. We hypothesize that the level of pain catastrophizing in patients after ureteral calculi surgery may be closely linked to their emotional state. Patients with high levels of pain catastrophizing may experience adverse emotional states, which can reduce postoperative patients' cooperation with their treatment, thereby impacting their prognosis.[12,13]

Previous studies on pain catastrophization were primarily status quo investigations and were unable to analyze the heterogeneity within the research subjects. In view of this, this study adopted latent profile analysis (LPA) to explore the latent profile categories of pain catastrophization in patients with ureteral calculi. Furthermore, it explored the characteristics of these categories and their correlation with emotional states, providing a reference for clinical medical staff to identify populations with a high level of pain catastrophization and to improve their positive emotions.

Subjects and Methods

Subjects of Study

Using the convenience sampling method, 260 patients diagnosed with ureteral calculi and admitted to Luzhou Maternal & Child Health Hospital between July 2024 and March 2025 were selected as the research subjects. This study received final approval from the Ethics Committee of Luzhou Maternal & Child Health Hospital (ethics number: 202406052). The inclusion criteria were as follows: (1) patients diagnosed with ureteral calculi and scheduled for extracorporeal shock wave lithotripsy; (2) adults aged 18 years or older; (3) those with a basic level of understanding and communication skills, all of whom signed informed consent forms. The exclusion criteria included: (1) a history of malignant tumors, nutritional or wasting diseases; (2) a history of cancer pain or other chronic pain conditions; (3) a history of psychological or mental disorders. To meet the sample size requirements, the minimum sample size was set at 5–10 times the number of independent variables.[14] The study utilized 18 independent variables (13 items of general information, 3 dimensions of the pain catastrophizing scale, and 2 dimensions of the emotional state scale), resulting in a minimum sample size of n=18×5=90, accounting for a 20% sample dropout rate and potential invalid questionnaires. Therefore, the minimum number of cases to be included was calculated as 90÷(1–20%)=113 cases. In this study, 260 cases were actually included.

Survey Instrument

General Information Questionnaire

The general information questionnaire was developed by the researchers themselves. It included questions about the patient's age, gender, education level, residence, living arrangements, income, marital status, duration of disease, frequency of pain, previous methods of pain control, self-rated social support (ranging from low to high), self-rated anxiety (categorized as none, mild, moderate, or severe), and self-rated self-efficacy (graded as low, medium, or high).

Pain Catastrophizing Scale (PCS)[15]

The scale was translated into Chinese by Yap and consists of three dimensions (rumination, magnification, and helplessness) with thirteen items. Each item is scored from 0 to 4, ranging from "never" to "always", with the total score

ranging from 0 to 52. A cut-off point of 37 indicates pain catastrophizing; scores exceeding this value signify a critical level of pain catastrophizing. A higher total score reflects a more severe level of pain catastrophizing. The original scale's internal consistency was 0.927, its test-retest reliability was 0.969, and the Cronbach's α coefficients for each dimension were 0.809, 0.768, and 0.839, respectively. The Cronbach's α coefficient for the scale in this study was 0.805.

Positive and Negative Affect Scales (PANAS)[16]

The scale was developed by Watson et al to evaluate individual emotional states. It comprises two dimensions: positive affect (10 items) and negative affect (10 items). High scores on negative affect items suggest that individuals are experiencing more negative emotions, whereas low scores indicate fewer negative emotions. Each item is rated on a scale from 1 ("never") to 5 ("always"), resulting in total scores ranging from 10 to 50 for both positive and negative affect. The Cronbach's α for the scale was 0.86 for positive affect and 0.84 for negative affect, with test-retest reliability scores of 0.68 for positive affect and 0.71 for negative affect. Construct validity and criterion validity were found to be good. The Cronbach's α coefficient for the scale in this study was 0.822.

Data Collection Methodologies

Initially, systematic training was conducted for all nurses involved in administering questionnaires to ensure uniformity in the distribution process. Prior to the official dissemination of the questionnaires, nursing personnel were required to explain the objectives and primary content of the survey to patients in detail, and subsequent actions could only be taken after obtaining explicit informed consent from the patients. Questionnaires were typically distributed when patients returned to the ward post-surgery and their condition was stable During the on-site questionnaire distribution process, nursing staff were tasked with meticulously examining the questionnaires to ensure there were no issues such as missing or incorrect responses. Once patients completed the questionnaires, they were collected immediately. Subsequently, researchers meticulously reviewed the returned questionnaires to verify their authenticity and completeness, and discarded any invalid questionnaires that did not meet the specified criteria. To ensure the accuracy of data entry, two researchers independently entered the survey results.

Statistical Methods

Data were statistically analyzed using SPSS 28.0 and Mplus 8.3 statistical software packages. Measurement data were described using mean and standard deviation, while count data were presented as frequency and percentage (%). *The t*-test and chi-square test were employed to analyze the influence factors between groups, evaluating the impact of various factors on different latent profiles. The significance level was set at $P < 0.05$. Mplus 8.3 software was utilized to analyze the Latent Profile of pain catastrophization in patients with ureteral calculi. Initially, the data model C1 was established, and the number of categories was incrementally increased. The optimal fitting model was selected by comparing the log-likelihood function value (Log(L)), Akaike information criterion (AIC), Bayesian information criterion (BIC), and sample size-adjusted BIC (aBIC) values. Additionally, the Lo-Mendell-Rubin adjusted likelihood ratio test (LRT), bootstrap-based likelihood ratio test (BLRT), and P-value were commonly used to assess the model fit. The entropy value was used to evaluate the accuracy of classification, with values closer to 1 indicating higher classification accuracy.

Results

Basic Information and Pain Catastrophizing Scale Scores

A total of 260 questionnaires were distributed. After excluding 22 invalid questionnaires, the effective recovery rate was 91.54%. Among the 238 patients, ages ranged from 22 to 84 years, with an average age of 48.24 ± 9.26 years. There were 174 males (73.11%) and 64 females (26.89%), as detailed in Table 1. The pain catastrophization score ranged from 5 to 48 points, with a total score of 28.43 ± 7.87 points.

Table 1 General Information of the Respondents (n=238)

Items	Categories	N	Percentage (%)	Items	Categories	N	Percentage (%)
Age (years)	< 45	87	36.55	Duration of disease (years)	< 1	158	66.39
	45 ~ 59	122	51.26		1 ~ 3	54	22.69
	≥60	29	12.19		> 3	26	10.92
Gender	Male	174	73.11	Number of pain	< 3	147	61.76
	Female	64	26.89		≥3	91	38.24
Level of education	Junior high school and below	71	29.83	Pain Control Methods	Medications	93	39.08
	High school	112	47.06		Non-drug	70	29.41
	Specialist and above	55	23.11		Nerve block	75	31.51
Monthly income (yuan)	< 3000	62	26.05	Self-rated anxiety status	No	50	21.01
	3000 -	114	47.90		Mild	108	45.38
	> 6000	62	26.05		Moderate	72	30.25
Marital status	Unmarried	20	8.40		Heavy	8	3.36
	Married	212	89.08	Self-rated social support	Low support	51	21.43
	Divorce	6	2.52		Medium support	131	55.04
Place of residence	Town	142	59.66		High support	56	23.53
	Rural	96	40.34	Self-rated self-efficacy	Low	74	31.09
Lifestyle	Live alone	21	8.82		In the	91	38.24
	Family residence	217	91.18		High	53	22.27

Latent Profile Analysis of Pain Catastrophizing in Patients with Ureteral Calculi

In this study, researchers selected the scores of 13 items as evaluation indicators for pain catastrophizing. Starting from the baseline model (with the number of categories set as 1), models containing 1 to 4 latent profiles were successively fitted and analyzed. The specific data are presented in Table 2. After comprehensive consideration and evaluation, the three Latent Profile models were ultimately determined as the optimal models for pain catastrophizing in patients with ureteral calculi.

The Average Attribution Rate of Three Latent Profiles of Pain Catastrophizing in Patients with Ureteral Calculi

To verify the reliability of the results from the analysis of the three latent profile categories, the average attribution probability for each class sample was calculated. The findings indicate that the average attribution probability ranges from 97.2% to 98.4%, all exceeding 90%. This suggests that the three latent profiles are reliable, as illustrated in Table 3.

Table 2 Comparison of Fitting Parameters of Different Latent Profile Models (n=238)

Models	AIC	BIC	aBIC	Entropy	LRT	BLRT	Class Probability
1	13843.256	13899.227	13837.838				
2	13217.912	13218.264	13123.914	1.000	0.000	< 0.001	0.34/0.66
3	12216.988	12458.720	12328.831	0.972	0.010	< 0.001	0.29/0.25/0.46
4	12111.536	12381.824	12224.849	0.981	0.131	< 0.001	0.24/0.18/0.26/0.32

Table 3 Average Attribution Rate of Three Types of Pain Catastrophizing (n=238)

Model	C1	C2	C3
C1	0.972	0.018	0.010
C2	0.016	0.978	0.006
C3	0.012	0.004	0.984

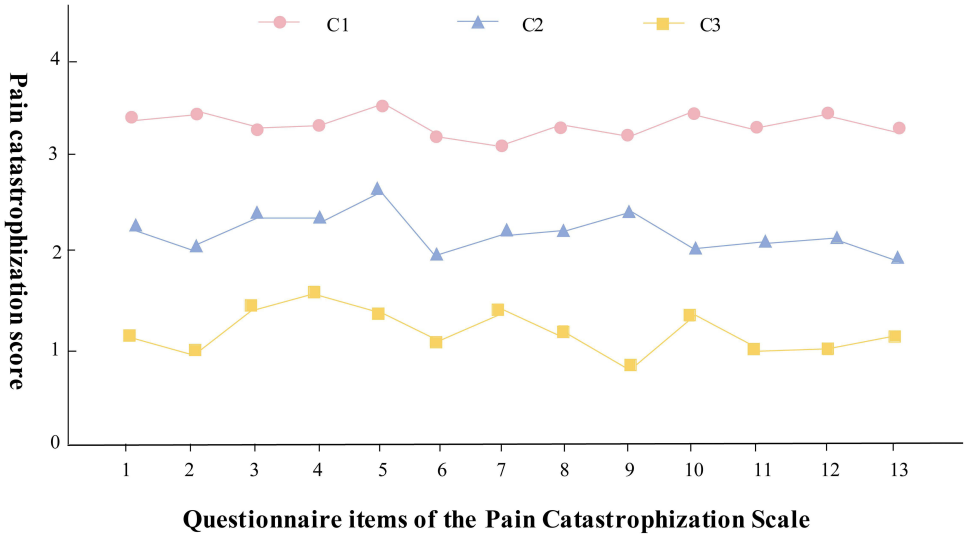

Figure 1 Line graph of Latent Profile of pain catastrophation in patients with ureteral calculi.

Latent Profile Analysis of Pain Catastrophizing in Patients with Ureteral Calculi

Based on the results of latent profile analysis, we found that patients with ureteral Calculi could be divided into three categories. By creating line plots of the scores for each dimension of the Pain Catastrophizing Scale (see Figure 1), we can more clearly analyze the characteristics of pain catastrophizing in patients with ureteral Calculi within these three latent profiles. The three latent profiles were named as follows: Category 1 (C1) was the "high pain catastrophizing group", accounting for 25.2% (60 cases); Category 2 (C2) was the "medium pain catastrophizing group", accounting for 46.2% (110 cases); and Category 3 (C3) was the "low pain catastrophizing group", accounting for 28.6% (68 cases).

Univariate Analysis of the Latent Profile of Pain Catastrophizing in Patients with Ureteral Calculi

The univariate analysis revealed significant differences among the three categories of groups in terms of living arrangements (χ^2=9.998, P=0.007), duration of disease (χ^2=14.540, P=0.006), frequency of pain (χ^2=21.169, P<0.001), and self-rated anxiety (χ^2=17.219, P<0.001). Additionally, social support (χ^2=10.612, P=0.031) also showed significant differences, as presented in Table 4.

Table 4 Univariate Analysis of General Information and Latent Profile of Pain Catastrophizing (n=238)

Variables	Group C1 (n=60)	Group C2 (n=110)	Group C3 (n=68)	χ^2	P-value
Age (years)				2.864	0.581
< 45	19	41	27		
45 ~ 59	31	59	32		
≥60	10	10	9		
Gender				2.611	0.271
Male	47	82	45		
Female	13	28	23		
Marital status				8.648	0.071
Unmarried	9	8	3		
Married	48	99	65		
Divorced	3	3	0		

(*Continued*)

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Table 4 (Continued).

Variables	Group C1 (n=60)	Group C2 (n=110)	Group C3 (n=68)	χ^2	P-value
Education				8.014	0.091
Junior high school and below	26	25	20		
High school	22	58	32		
Junior college and above	12	27	16		
Place of residence				0.766	0.682
Town	33	68	41		
Rural	27	42	27		
Way of living				9.998	0.007
Living alone	11	8	2		
Family living	49	102	66		
Monthly income (yuan)				1.756	0.781
< 3000	18	30	14		
3000 -	27	51	36		
> 6000	15	29	18		
Duration of disease (years)				14.540	0.006
< 1	31	71	56		
1 ~ 3	18	27	9		
> 3	11	12	3		
Number of pain				21.169	< 0.001
< 3	26	65	56		
≥3	34	45	12		
Pain Control Methods				3.690	0.450
Medications	25	44	24		
Non-medication	15	29	26		
Nerve block	20	37	18		
Self-rated anxiety status				17.219	0.009
No	5	24	21		
Mild	25	54	29		
Moderate	26	28	18		
Severe	4	4	0		
Self-rated social support				10.612	0.031
Low support	17	22	12		
Medium support	35	63	31		
High support	8	25	25		
Self-rated self-efficacy				4.077	0.396
Low	22	37	15		
In the	25	51	35		
High	13	22	18		

Note: C1 is "high pain catastrophizing group", C2 is "medium pain catastrophizing group", C3 is "low pain catastrophizing group".

Logistic Regression Analysis of the Latent Profile of Pain Catastrophizing in Patients with Ureteral Calculi

The pain catastrophizing group of patients with ureteral calculi was used as the dependent variable, and the indicators with statistically significant differences in univariate analysis were used as the independent variables for logistic regression analysis. The results indicated that, with group C3 as the reference, the living arrangements (assignment: living alone = 1, family living = 2, with living alone as the control), duration of disease (< 1 year = 1, 1–3 years = 2, > 3 years = 3, with < 1 year as the control), number of pain episodes (< 3 times = 1, ≥3 times = 2, with < 3 times as the control), self-rated anxiety (none = 1, mild = 2, moderate = 3, severe = 4, $P < 0.05$), and social support (low support = 1,

Table 5 Logistic Regression Analysis of Change Trajectory of Pain Catastrophizing in Patients with Ureteral Calculi (n=238)

Items	B value	Standard Error	Walds χ^2 value	P-value	OR value	Upper Limit of 95% CI	Lower Limit of 95% CI
Group C1 vs group C3							
Constants	2.053	0.440	21.771	< 0.001	-	-	-
Lifestyle							
Family residence	−0.333	0.138	5.823	0.029	0.717	0.547	0.939
Duration of illness (years)							
1 ~ 3	0.379	0.134	8.000	0.008	1.461	1.123	1.900
> 3	0.586	0.150	15.262	< 0.001	1.797	1.339	2.411
Number of pain							
≥3 times	0.814	0.247	10.861	< 0.001	2.257	1.391	3.662
Self-rated anxiety status							
Mild	0.349	0.105	11.048	< 0.001	1.418	1.154	1.742
Moderate	0.467	0.141	10.970	< 0.001	1.595	1.210	2.103
Severe	0.603	0.162	13.855	< 0.001	1.828	1.330	2.511
Social support							
Medium support	−0.437	0.179	5.960	0.028	0.646	0.455	0.917
High support	−0.612	0.238	6.612	0.019	0.542	0.340	0.865
Group C2 vs Group C3							
Constants	1.943	0.357	29.622	< 0.001	-	-	-
Mode of living							
Family residence	−0.278	0.096	8.386	0.006	0.757	0.627	0.914
Duration of illness (years)							
1 ~ 3	0.305	0.103	8.768	0.002	1.357	1.109	1.660
> 3	0.414	0.117	12.521	< 0.001	1.513	1.203	1.903
Number of pain							
≥3 times	0.667	0.161	17.163	< 0.001	1.948	1.421	2.671
Self-rated anxiety status							
Mild	0.303	0.124	5.971	0.028	1.354	1.062	1.726
Moderate	0.411	0.109	14.218	< 0.001	1.508	1.218	1.868
Severe	0.572	0.153	13.977	< 0.001	1.772	1.313	2.391
Social support							
Medium support	−0.400	0.185	4.675	0.042	0.670	0.466	0.963
High support	−0.523	0.179	8.537	0.004	0.593	0.417	0.842

Note: C1 is "high pain catastrophizing group", C2 is "medium pain catastrophizing group", C3 is "low pain catastrophizing group".

medium support = 2, high support = 3, with low support as the control) were closely related to pain catastrophization ((P < 0.05). Table 5 presents these results.

Analysis of the Differences in Emotional States of Ureteral Calculi Patients with Different Profiles of Pain Catastrophizing

The positive emotion score of 238 patients with ureteral calculi was (25.32±7.33), and the negative emotion score was (20.75±6.48). The emotional state scores of ureteral calculi patients with different pain catastrophizing profiles were analyzed and compared. The results indicated that, in terms of positive emotion, the positive emotional state level of patients in the high pain catastrophizing group was significantly lower than that in the medium pain catastrophizing group (P < 0.01) and significantly lower than that in the low pain catastrophizing group (P < 0.01). Additionally, the positive emotional state level of patients in the medium pain catastrophizing group was significantly lower than that in the low pain catastrophizing group (P < 0.01). Regarding the level of negative emotion, patients in the high pain catastrophizing group exhibited a significantly lower level compared to those in the low pain catastrophizing group (P < 0.01) and the

Table 6 Difference Analysis of Emotional State in Ureteral Calculi Patients with Different Pain Catastrophizing Profiles

Variables	Group C1	Group C2	Group C3	F	Compare the Results in Pairs
Positive Affect score	21.25±6.90	25.44±7.11	28.72±5.78	9.337	C1 < C3[1)], C1 < C2[1)], C2 < C3[1)]
Negative Affect score	22.17±6.67	20.67±5.95	19.63±5.57	13.774	C1 < C3[1)], C1 < C2[2)]

Note: C1 is "high pain catastrophizing group", C2 is "medium pain catastrophizing group", C3 is "low pain catastrophizing group", [1)] denotes P < 0.01, [2)] denotes P < 0.01.

medium pain catastrophizing group (P < 0.05). However, there was no significant difference in the level of negative emotional state between patients in the medium and low pain catastrophizing groups, as detailed in Table 6.

Discussion

The results of this study indicate that the pain catastrophization of patients with ureteral calculi can be categorized into three potential profile groups: the high pain catastrophization group, the medium pain catastrophization group, and the low pain catastrophization group. Patients in the high pain catastrophization group (25.2%) exhibit a heightened sensitivity to pain, characterized by an excessive activation that leads to the magnification of pain signals.[17] This group also presents with psychological susceptibility factors, such as anxiety traits, which may stem from the intense pain memory associated with acute renal colic and the ongoing discomfort from postoperative ureteral stents.[18] Furthermore, patients' lack of awareness regarding the risk of disease recurrence contributes to their heightened sensitivity to pain and negative expectations.[18] Schumann et al[19] and Craner et al[20] have both noted that pain catastrophization is a significant contributor to patients' feelings of helplessness and rumination. Reducing the level of pain catastrophization in patients can be beneficial for stabilizing their emotional state. The pain catastrophization group (46.2%), which constitutes the largest proportion, is significantly influenced by situational factors in their response patterns. Variables such as the duration of postoperative stent discomfort and the adequacy of medical information acquired play a crucial role. The low pain catastrophization group (28.6%) typically possesses effective pain coping strategies, which may be attributed to a well-developed social support system, accurate medical understanding, and higher pain self-efficacy. This implies that clinical medical staff should implement interventions and management tailored to the different groups. For the high pain catastrophization group, the focus should be on psychological interventions, such as drug analgesia combined with mindfulness-based stress reduction. For the medium pain catastrophization group, improvements can be made by enhancing doctor-patient communication and symptom management. Meanwhile, for the low pain catastrophization group, it is essential to sustain their existing adaptive coping mechanisms.

The results of this study indicate that living arrangements, disease duration, frequency of pain, self-rated anxiety status, and social support are closely associated with pain catastrophization. The impact of living arrangements on pain catastrophizing was also documented in Bimali et al's study.[21] Patients living alone are more susceptible to feeling helpless in the face of postoperative pain due to the absence of immediate care and support. This state of social isolation can intensify their negative perception of pain as a threat. Patients with longer disease durations are likely to undergo multiple treatments or experience relapses, which can lead to a cumulative effect of pain memory and make them overly sensitive to pain stimuli. Frequent pain episodes can enhance central sensitization via neuroplasticity changes, lower pain thresholds, and exacerbate catastrophic thoughts.[22] Patients with high self-rated anxiety levels have impaired emotional regulation of pain. Such patients struggle to effectively employ cognitive strategies to manage their pain experience and are prone to ruminative thinking, making them more susceptible to catastrophizing their pain.[23,24] Insufficient social support directly affects patients' psychological resilience, and the lack of effective emotional catharsis channels and problem-solving resources can weaken their ability to cope with pain.[25]

The results of this study reveal a gradient relationship between pain catastrophization and emotional state. From a psychological perspective, this gradient relationship can be explained by emotion regulation theory and the cognitive resource allocation model. Patients in the high pain catastrophization group exhibited typical cognitive evaluation biases, and their attention bias mechanisms caused pain-related stimuli to consume excessive cognitive resources, leading to

significant mental energy depletion in maintaining positive emotions.[26,27] Simultaneously, the rumination thinking pattern of these patients creates a vicious cycle, continuously reinforcing the experience of negative emotions and hindering the emergence of positive emotions. Although patients in the moderate pain catastrophization group possess basic emotional regulation abilities, their positive emotional expression remains significantly limited due to persistent pain-related worries occupying working memory capacity.[28,29] In terms of negative emotion, patients in the high score group experienced dysfunction in their emotional processing systems, with attention and memory biases towards negative stimuli amplifying their negative emotional experiences. In contrast, patients in the medium and low score groups could moderately regulate their negative emotions, as they retained relatively intact cognitive reappraisal abilities. This difference in psychological mechanisms suggests that the degree of pain catastrophizing substantially reflects the effectiveness of patients' emotional regulation strategies. Patients in the high score group lack adaptive coping resources and struggle to balance the emotional impact of pain through cognitive reconstruction.[30]

This study has certain limitations; the use of convenience sampling may reduce the universality of the sample. Secondly, there may be some omissions in the related factors of pain catastrophizing ability. In the future, we plan to expand the sample size and enhance the discussion of related factors to better identify ureteral calculi patients with different profiles of pain catastrophizing. Finally, this study was conducted using patient-reported outcomes, which may lead to an increased risk of reporting bias. Future studies will incorporate more objective data to optimize the results.

Summary

In this study, Latent Profile Analysis was utilized to categorize the pain catastrophizing of patients with ureteral calculi into three distinct Latent Profile groups: high, medium, and low. These groups are closely associated with various factors, including the patients' living arrangements, duration of disease, frequency of pain, self-reported anxiety levels, and social support. The pain catastrophizing levels within these profiles are significantly correlated with the patients' emotional states. Medical personnel should prioritize the assessment of the psychological well-being of patients with ureteral calculi, particularly those who live alone, have a long history of the disease, experience recurrent pain episodes, and suffer from anxiety. It is crucial to identify their elevated risk of a pain catastrophe early on and to implement personalized management strategies. These strategies should aim to enhance the social support network, employ cognitive-behavioral interventions, and integrate non-pharmacological analgesia techniques. The goal is to disrupt the negative cycle of "pain - anxiety - increased pain" and to enhance the patients' prognoses. Future research should explore the efficacy of targeted psychological intervention programs tailored to different pain catastrophizing profiles. Longitudinal studies could track the dynamic relationship between pain catastrophizing and emotional states and its effect on long-term recovery outcomes. Additionally, the development of rapid assessment tools suitable for clinical settings could help optimize pain management protocols.

Abbreviations

ESWL, Extracorporeal shock wave lithotripsy; PCS, Pain Catastrophizing Scale; PANAS, Positive and negative affect scales; LPA, Latent profile analysis; Log(L), Log-likelihood function value; AIC, Akaike information criterion; BIC, Bayesian information criterion; aBIC, sample size-adjusted BIC; LRT, Lo-Mendell-Rubin adjusted likelihood ratio test; BLRT, Bootstrap-based likelihood ratio test.

Ethics and Consent Statements

Informed consent was obtained from all patients in this study. This study was finally approved by the Ethics Committee of Luzhou Maternal & Child Health Hospital, and all investigative procedures were strictly conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Disclosure

The authors have no conflicts of interest to disclose for this work.

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