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ORIGINAL RESEARCH

Quantitative Assessment of Psychological Stress Changes Before and After Ureteral Stent Placement: A Prospective Observational Study

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Background: Ureteral stents are commonly used in urological procedures, with approximately 2 million placements annually worldwide. While physical complications are well-documented, psychological impacts remain understudied. This study aimed to quantitatively evaluate psychological stress changes before and after ureteral stent placement in order to better understand patients' psychological needs during this common urological procedure.

Methods: This prospective observational study with paired before-after measurements was conducted at Yangjiang Hospital of Traditional Chinese Medicine between November 2024 and March 2025. We enrolled 82 patients who underwent ureteral stent placement following ureteroscopic lithotripsy. Psychological assessments using the Chinese version of the Perceived Stress Scale and Emotional Distress Inventory were performed at two time points: immediately before stent insertion and during the stent indwelling period. Data were analyzed using paired *t*-tests, ANOVA, and multiple linear regression.

Results: Total perceived stress scores increased significantly from baseline to stent indwelling period (14.40±9.85 vs 23.90±10.06, $p<0.001$), representing a 66.0% increase. The tension dimension demonstrated the most pronounced change (77.8% increase: from 6.40±3.32 to 11.38±5.12, $p<0.001$), while helplessness increased by 56.5% (from 8.00±7.09 to 12.52±6.62, $p<0.001$). Secondary analyses showed significant gender differences, with females reporting higher helplessness scores than males (12.32±8.00 vs 4.44 ±3.37, $p<0.001$). Stent duration ≥1 month was associated with greater helplessness compared to <1 month (12.97±6.95 vs 9.64±2.66, $p=0.006$). Emotional distress analysis revealed anhedonia in 75.6–79.3% of patients, while emotional fluctuations were less common (14.6–45.1%). Multiple regression confirmed gender as an independent predictor of helplessness ($\beta=-0.371$, $p=0.001$).

Conclusion: Ureteral stent placement significantly increases psychological stress, particularly tension and helplessness dimensions. Female patients and those with prolonged stent duration are at higher risk for psychological distress. Clinicians should proactively address patients' psychological needs through targeted patient education, especially for high-risk populations, to improve patient experience during the stent indwelling period.

Keywords: ureteral stent, psychological stress, gender differences, patient education

Introduction

Ureteral stents, also known as "double J stents", are commonly used medical devices in urology. They are extensively utilized in various pathological conditions including urinary calculi, neoplasms, stenosis, and postoperative drainage. Common clinical indications include prevention of ureteral stenosis following calculi removal procedures and alleviation of ureteral obstruction caused by extrinsic tumor compression. These interventions effectively preserve renal function and reduce postoperative complications such as infection and urinary extravasation.[1] Double J stents primarily function by facilitating urine drainage from the upper urinary tract directly to the bladder,[2] serving as both internal drainage

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conduits and structural support mechanisms.[3] Epidemiological data indicate that over 2 million ureteral stent placements are performed annually worldwide.[4] Approximately 70% of recipients experience varying degrees of stent-related symptoms, including lower urinary tract manifestations, hematuria, and pain.[5] Clinical studies demonstrate that ureteral stents not only induce physical discomfort but may also precipitate psychological sequelae including sleep disturbances and anxiety disorders.[6] A systematic review by Ní Néill et al[7] revealed that the cumulative incidence of anxiety among calculi patients reaches 39.2%, with depression reported at 25.9%. Stent insertion potentially exacerbates this psychological burden. These findings suggest that the psychological distress experienced by patients with indwelling ureteral stents represents an underappreciated yet clinically significant phenomenon.

The global incidence of urolithiasis continues to rise annually, correlating with elevated living standards and dietary modifications.[8–10] Epidemiological surveillance data indicate that the prevalence of urolithiasis in China has reached 6.4%.[11] Prophylactic ureteral stent placement following minimally invasive lithiasis procedures serves to mitigate ureteral edema and renal colic complications. Additionally, it facilitates optimal urinary drainage, promoting ureteral mucosal healing and fragment evacuation.[12] Standard protocol dictates stent removal via cystoscopy under urethral mucosal anesthesia, typically performed 2–4 weeks post-insertion.

While ureteral stents demonstrate efficacy in pain management and calculi expulsion, their prolonged presence as foreign bodies can directly irritate the vesical trigone, precipitating various complications. These complications include gross hematuria, infection, and irritative pain syndromes.[13] Such discomforts variably intensify anxiety symptoms during the stent indwelling period,[14] compromising quality of life and generating illness perception distress. Concurrently, insufficient patient understanding regarding stent removal procedures, coupled with post-procedural micturition pattern alterations, contributes to psychological distress and anticipatory anxiety,[15] adversely affecting daily function and occupational performance.

Therefore, this investigation employs longitudinal assessment of perceived stress and emotional disturbance scales in post-stent patients to quantify psychosocial impact. By evaluating the effects of indwelling ureteral stents on patients' functional status, this study aims to identify interventions for minimizing negative psychological sequelae within clinically appropriate parameters.

Methods

Subjects

A prospective analysis was conducted on patients who underwent ureteral stent placement in the Department of Urology at Yangjiang Hospital of Traditional Chinese Medicine between November 2024 and March 2025, and who voluntarily returned for stent removal. All patients underwent ureteroscopic lithotripsy (URS) for stone removal, with prophylactic ureteral stent placement performed immediately following the procedure to prevent ureteral edema and renal colic complications.

Inclusion criteria comprised: (1) patients with indwelling ureteral stents following ureteroscopic lithotripsy (URS) procedures for renal-ureteral calculi who completed scheduled stent removal; (2) absence of psychiatric history; (3) no contraindications for stent removal procedure; and (4) voluntary participation in the study.

Exclusion criteria were defined as: (1) ureteral injury, atresia, or significant stenosis; (2) coagulation disorders; (3) psychiatric conditions including depression; (4) urinary tract infection complicating postoperative stent placement; (5) comorbid advanced malignancy or severe heart failure; and (6) history of substance abuse or alcohol dependence.

All participants completed the Chinese version of the Perceived Stress Scale prior to stent insertion. Upon readmission, stent removal procedures were performed by the same attending physician. Before the removal procedure, patients completed two self-assessment questionnaires: the Chinese version of the Perceived Stress Scale and the Emotional Distress Inventory, to evaluate psychological status during the stent indwelling period.

Sample Size Calculation

Sample size calculation was performed using G*Power software. Based on the clinical significance threshold for psychological stress measures, we anticipated a medium effect size (Cohen's d = 0.5) representing a clinically

meaningful change in perceived stress. With α = 0.05, power = 0.80, and accounting for a 10% dropout rate, the calculated required sample size was 80 patients. During the study period, consecutive patients meeting inclusion criteria were enrolled. A total of 101 patients were initially assessed for eligibility, with 16 patients excluded (11 had contraindications for stent removal, 5 declined participation). Eighty-five patients were enrolled and completed questionnaires with 100% collection rate. Three questionnaires were excluded from analysis due to incomplete baseline stress assessments (n=2) and inconsistent responses (n=1). The final analysis included 82 valid questionnaires, yielding an effective response rate of 96.47%, which exceeded our predetermined sample size requirement.

Data Collection

Two complementary psychological assessment tools were employed to comprehensively evaluate patients' mental health status. The Chinese version of the Perceived Stress Scale was used to assess patients' overall stress perception and coping abilities, focusing on cognitive appraisal of stressful situations. The Emotional Distress Inventory was used to evaluate specific emotional symptoms including anxiety, depression, and psychological distress manifestations. These two scales measure different but related dimensions of psychological well-being - stress perception versus emotional symptom expression - providing a more comprehensive assessment than either scale alone.

1) The Chinese version of the Perceived Stress Scale was adapted based on the validated instrument reported by Li et al.[16] This instrument comprises 14 stress-related items categorized into two dimensions. Each item offers five response options ("never", "almost never", "sometimes", "often", and "always"), scored from 0 to 4, respectively. Items 4, 5, 6, 7, 9, 10, and 13 represent positively-worded statements in the "loss of control" dimension and utilize reverse scoring. Items 1, 2, 3, 8, 11, 12, and 14 represent negatively-worded statements in the "perceived tension" dimension and utilize standard scoring. The total score ranges from 0 to 56, with higher scores indicating greater psychological stress.
2) The Emotional Distress Scale was adapted from the Patient-Reported Outcomes Measurement Information System (PROMIS).[17] This modified instrument evaluates five domains: anxiety, depression, psychological distress, emotional fluctuation, and anhedonia. The first three domains employ a 0–4 scale, representing frequency from "never" (0) to "always" (4). Higher scores correlate with greater emotional distress. The remaining two domains utilize a binary "yes/no" response format.
3) Demographic and clinical data were collected and analyzed. Data were extracted from electronic medical records, including sex, age, occupation, stent location, and indwelling duration.

Enrolled participants were instructed to complete electronic questionnaires via a digital survey platform (WJX) during their hospital visit for stent removal, facilitating systematic data collection. A single attending physician provided standardized instructions to all participants, explaining the questionnaire content, objectives, completion guidelines, and terminology. Informed consent was obtained prior to data collection, and efforts were made to establish effective communication, thereby ensuring objective and accurate responses. The physician provided clarification and guidance when participants encountered difficulties completing the questionnaire. Due to the observational nature of this study, blinding of participants was not feasible. However, statistical analyses were initially conducted by researchers blinded to specific patient characteristics to minimize bias in data interpretation.

Reliability and Validity Analysis

Statistical analyses revealed excellent psychometric properties for both instruments. Regarding reliability, the Chinese version of the Perceived Stress Scale demonstrated a high overall internal consistency (Cronbach's α = 0.933), with coefficient values of 0.965 and 0.714 for its two dimensions, respectively. The Emotional Distress Scale exhibited dimension-specific Cronbach's α coefficients ranging from 0.707 to 0.905, all exceeding the acceptable threshold of 0.6 (Table 1). For validity assessment, exploratory factor analysis revealed Kaiser-Meyer-Olkin (KMO) coefficients of 0.864 and 0.927 for the respective scales, both indicating excellent sampling adequacy (>0.8). Additionally, Bartlett's test of sphericity yielded significance values approaching zero, confirming the structural validity of both instruments (Table 2).

Table 1 Internal Consistency Reliability of the Perceived Stress Scale and Emotional Distress Scale

Scale/Dimension	Number of Items	Cronbach's α
Perceived Stress Scale	14	0.933
Feeling of Loss of Control	7	0.965
Tension	7	0.714
Emotional Distress Scale	16	0.905
Depression	5	0.777
Anxiety	4	0.803
Psychological Distress	2	0.786
Emotional Instability	3	0.707
Loss of Pleasure	2	0.765

Notes: Reliability was assessed using Cronbach's alpha coefficient (α). Values above 0.70 indicate acceptable internal consistency.

Table 2 Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity for Scale Validation

Statistical Test	Perceived Stress Scale	Emotional Distress Scale
KMO Measure of Sampling Adequacy	0.864	0.927
Bartlett's Test of Sphericity		
Approximate Chi-Square	740.525	979.304
Degrees of Freedom	120	91
p-value	< 0.001	< 0.001

Notes: KMO values above 0.8 indicate excellent sampling adequacy. The significant Bartlett's Test results ($p < 0.001$) indicate that the correlation matrices are significantly different from identity matrices, confirming the appropriateness of factor analysis.

In conclusion, both instruments demonstrated robust psychometric properties that meet the rigorous standards of measurement science, thereby providing reliable and stable data for this investigation.

Ethic Statement

This study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of Yangjiang Hospital of Traditional Chinese Medicine. Written informed consent was obtained from all participants prior to their inclusion in the study. All participants were informed about the purpose of the study, the procedures involved, potential risks and benefits, and their right to withdraw from the study at any time without any negative consequences. The confidentiality and anonymity of all participants were strictly maintained throughout the research process.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics software (version 23.0). Categorical data were presented as frequencies and percentages (%). Normally distributed continuous variables were expressed as mean ± standard deviation ($\bar{x} \pm s$). Between-group comparisons were conducted using independent *t*-tests or analysis of variance (ANOVA). Paired-samples *t*-tests were used to compare perceived stress scores before and after stent placement. Factors associated with perceived stress in patients with indwelling ureteral stents were examined using multiple linear regression analysis. All statistical tests were two-tailed, with $P \leq 0.05$ considered statistically significant. Sample size calculation was performed using G*Power software (version 3.1.9.7) with the following parameters: effect size (Cohen's d) = 0.5, α error probability = 0.05, power (1-β error probability) = 0.80, and allocation ratio = 1. The calculation was based on a paired-samples *t*-test design to detect differences in perceived stress scores before and after stent placement.

Results

Baseline Characteristics of Participants

A total of 82 patients with indwelling ureteral stents were enrolled in this study, comprising 45 males (54.9%) and 37 females (45.1%). The occupational distribution was predominantly agricultural workers (51.2%), followed by self-employed individuals (19.5%) and unemployed persons (12.2%). Regarding stent laterality, 38 patients (46.3%) had right-sided stents, 35 (42.7%) had left-sided stents, and 9 (11.0%) had bilateral stents. The majority of participants (82.9%) were between 30 and 65 years of age, while 12.2% were older than 65 years. Most patients (86.6%) had stent indwelling duration of one month or longer.

Factors Associated with Perceived Stress in Patients with Ureteral Stent Placement

Univariate analysis of demographic and clinical factors associated with perceived stress in patients following ureteral stent placement revealed several significant findings (Table 3). Gender emerged as a strong determinant of perceived stress, with female patients reporting significantly higher scores than male patients in both perceived helplessness (12.32 ±8.00 vs 4.44±3.37, t=5.60, p<0.001) and perceived tension (6.86±3.58 vs 2.91±1.78, t=6.12, p<0.001). Occupational status also demonstrated significant associations with both dimensions of perceived stress. Significant differences were observed across occupational groups in perceived helplessness (F=2.49, p=0.030) and perceived tension (F=3.18, p=0.008). Notably, retired individuals reported the highest levels of stress in both dimensions (helplessness: 19.00 ±2.83; tension: 14.00±2.83), followed by civil servants and self-employed persons, while industrial workers reported the lowest levels of perceived helplessness (1.25±1.50). The duration of stent placement significantly influenced perceived helplessness, with patients having stents for ≥1 month experiencing greater feelings of helplessness compared to those with stents for <1 month (12.97±6.95 vs 9.64±2.66, t=−2.90, p=0.006). However, no significant difference was found in

Table 3 Univariate Analysis of Perceived Stress Dimensions After Ureteral Stent Placement

Characteristic	n (%)	Loss of Control Dimension	Tension Dimension
Gender		t = 5.60, p < 0.001	t = 6.12, p < 0.001
Female	37 (45.1)	12.32 ± 8.00	6.86 ± 3.58
Male	45 (54.9)	4.44 ± 3.37	2.91 ± 1.78
Occupation		F = 2.49, p = 0.030	F = 3.18, p = 0.008
Farmer	42 (51.2)	8.10 ± 6.80	6.14 ± 3.17
Worker	4 (4.9)	1.25 ± 1.50	5.00 ± 0.82
Unemployed	10 (12.2)	6.00 ± 6.65	5.60 ± 2.91
Office worker	6 (7.3)	4.50 ± 3.02	4.67 ± 2.25
Self-employed	16 (19.5)	9.81 ± 7.97	7.25 ± 3.49
Retired	2 (2.4)	19.00 ± 2.83	14.00 ± 2.83
Civil servant	2 (2.4)	14.50 ± 9.19	9.50 ± 2.12
Stent position		F = 0.71, p = 0.496	F = 1.01, p = 0.367
Left	35 (42.7)	9.00 ± 7.67	6.91 ± 3.76
Right	38 (46.3)	7.03 ± 6.71	5.84 ± 2.78
Bilateral	9 (11.0)	8.22 ± 6.40	6.78 ± 3.63
Age group (years)		F = 1.16, p = 0.318	F = 0.53, p = 0.593
<30	4 (4.9)	15.20 ± 7.53	13.20 ± 4.97
30-65	68 (82.9)	12.00 ± 6.46	11.12 ± 4.92
>65	10 (12.2)	14.70 ± 7.21	12.20 ± 6.63
Stent duration		t = −2.90, p = 0.006	t = −0.90, p = 0.373
<1 month	11 (13.4)	9.64 ± 2.66	10.09 ± 4.89
≥1 month	71 (86.6)	12.97 ± 6.95	11.58 ± 5.16

Notes: Data are presented as mean ± standard deviation. Statistical significance was set at p < 0.05. Significant p-values are shown in bold. Independent samples t-tests were used for comparisons between two groups, and one-way ANOVA was used for comparisons among three or more groups.

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perceived tension based on stent duration (t=−0.90, p=0.373). Interestingly, neither stent position (left, right, or bilateral) nor age group demonstrated significant associations with either dimension of perceived stress (all p>0.05). These findings highlight the importance of considering demographic factors, particularly gender and occupation, along with the duration of stent placement when evaluating and addressing stress responses in patients with ureteral stents.

Analysis of Perceived Stress Before and After Ureteral Stent Placement

Comparative analysis of patients' perceived stress levels before and during ureteral stent placement revealed substantial increases across all measured dimensions (Table 4). The total perceived stress score increased from 14.40 ± 9.85 before stent placement to 23.90 ± 10.06 during the stent indwelling period, representing a 66.0% increase in overall perceived stress. When examining specific dimensions of perceived stress, the perceived tension dimension demonstrated the most pronounced change, with mean scores increasing from 6.40 ± 3.32 to 11.38 ± 5.12, reflecting a 77.8% elevation. Similarly, the perceived helplessness dimension showed a considerable increase from 8.00 ± 7.09 to 12.52 ± 6.62, corresponding to a 56.5% rise. These findings indicate that ureteral stent placement is associated with a marked deterioration in patients' psychological well-being, characterized by heightened feelings of tension, strain, and helplessness. The disproportionate increase in the tension dimension suggests that the physical discomfort and restrictions associated with stent placement may particularly exacerbate patients' experiences of psychological strain and pressure during the indwelling period.

Factors Associated with Emotional Distress Following Ureteral Stent Placement

We conducted a univariate analysis to examine emotional distress outcomes (Table 5). Our findings indicated no statistically significant differences in depression, anxiety, or psychological distress scores between male and female

Table 4 Perceived Stress Scores Before and During Ureteral Stent Placement (N = 82)

Time Period	Loss of Control	Tension	Total Perceived Stress
Before ureteral stent placement	8.00 ± 7.09	6.40 ± 3.32	14.40 ± 9.85
During ureteral stent placement	12.52 ± 6.62	11.38 ± 5.12	23.90 ± 10.06
t-value	−4.52	−7.93	−6.97
p-value	<0.001	<0.001	<0.001
Cohen's d	0.67	1.16	0.97

Notes: Data are presented as mean ± standard deviation. Statistical significance was determined using paired samples t-tests. Cohen's d values represent effect sizes, where 0.2 indicates small effect, 0.5 indicates medium effect, and 0.8 indicates large effect.

Table 5 Univariate Analysis of Emotional Distress Dimensions After Ureteral Stent Placement (N = 82)

Characteristic	n (%)	Depression	Anxiety	Psychological Distress
Gender		t = 1.60, p = 0.114	t = 1.36, p = 0.177	t = 0.74, p = 0.461
Female	37 (45.1)	8.35 ± 3.52	7.05 ± 3.06	3.73 ± 1.71
Male	45 (54.9)	6.98 ± 4.14	6.11 ± 3.17	3.42 ± 1.99
Occupation		F = 1.24, p = 0.297	F = 1.71, p = 0.130	F = 0.89, p = 0.506
Farmer	42 (51.2)	7.26 ± 3.43	6.50 ± 2.93	3.52 ± 1.69
Worker	4 (4.9)	7.25 ± 1.50	7.25 ± 0.96	3.50 ± 1.29
Unemployed	10 (12.2)	6.80 ± 3.43	5.10 ± 3.35	3.20 ± 2.53
Office worker	6 (7.3)	9.17 ± 5.98	7.00 ± 4.00	2.83 ± 1.84
Self-employed	16 (19.5)	7.81 ± 4.40	6.38 ± 3.26	3.75 ± 2.02
Retired	2 (2.4)	14.00 ± 7.07	12.50 ± 2.12	6.00 ± 1.41
Civil servant	2 (2.4)	6.50 ± 3.54	7.00 ± 0.00	4.50 ± 2.12

(*Continued*)

Table 5 (Continued).

Characteristic	n (%)	Depression	Anxiety	Psychological Distress
Stent position		F = 2.71, p = 0.073	F = 0.95, p = 0.391	F = 1.86, p = 0.162
Right	38 (46.3)	6.74 ± 3.77	6.31 ± 2.98	3.11 ± 1.83
Left	35 (42.7)	7.82 ± 3.38	6.42 ± 3.16	3.84 ± 1.87
Bilateral	9 (11.0)	10.00 ± 5.61	7.89 ± 3.66	4.11 ± 1.83
Age group (years)		F = 0.17, p = 0.842	F = 0.56, p = 0.573	F = 0.01, p = 0.993
<30	4 (4.9)	8.60 ± 6.50	5.40 ± 3.13	3.60 ± 2.51
30-65	68 (82.9)	7.54 ± 3.27	6.70 ± 2.70	3.57 ± 1.76
>65	10 (12.2)	7.50 ± 6.29	6.00 ± 5.42	3.50 ± 2.42
Stent duration		t = −0.63, p = 0.533	t = 0.22, p = 0.830	t = 0.49, p = 0.626
<1 month	11 (13.4)	6.91 ± 3.08	6.73 ± 2.97	3.82 ± 1.99
≥1 month	71 (86.6)	7.70 ± 4.03	6.51 ± 3.18	3.52 ± 1.86
Total	82 (100)	7.60 ± 3.91	6.54 ± 3.14	3.56 ± 1.87

Notes: Data are presented as mean ± standard deviation. Statistical significance was set at $p < 0.05$. Independent samples t-tests were used for comparisons between two groups, and one-way ANOVA was used for comparisons among three or more groups.

patients ($p > 0.05$). Similarly, no significant differences were observed across various occupational groups ($p > 0.05$). Although the variable of stent location showed a near-significant influence on depression scores ($p = 0.073$), with bilateral stenting showing slightly higher scores, this was not statistically conclusive. Age groups also demonstrated no significant differences in emotional distress outcomes ($p > 0.05$). Lastly, the duration of stent placement (<1 month vs ≥1 month) did not significantly affect depression, anxiety, or psychological distress scores ($p > 0.05$).

Emotional Disturbances in Patients with Ureteral Stent Placement

Analysis of emotional responses in patients with ureteral stent placement (n=82) revealed a high prevalence of anhedonia symptoms (Table 6). Loss of interest in activities was reported by 79.3% of patients, while 75.6% experienced reduced enjoyment of previously pleasurable activities. Emotional fluctuations were less prevalent but still significant, with 45.1% of patients reporting being easily provoked by minor issues and 34.1% experiencing increased anger or irritation. Dramatic mood swings were relatively uncommon, affecting only 14.6% of the study population. These findings indicate

Table 6 Frequency of Emotional Fluctuation and Anhedonia in Patients with Ureteral Stent (n=82)

Item	Response	n	%
Emotional Fluctuation			
Easily angered or irritated (Q10)[a]	No	54	65.9
	Yes	28	34.1
Easily provoked by minor issues (Q11)[b]	No	45	54.9
	Yes	37	45.1
Experienced dramatic mood changes (Q12)[c]	No	70	85.4
	Yes	12	14.6
Anhedonia			
Loss of interest in activities (Q13)[d]	No	17	20.7
	Yes	65	79.3
Decreased enjoyment of previously liked activities (Q14)[e]	No	20	24.4
	Yes	62	75.6

Notes: [a]During the ureteral stent placement period, did you easily feel angry or irritated? [b]During the ureteral stent placement period, were you easily provoked by minor issues? [c]During the ureteral stent placement period, did you experience dramatic mood changes (eg, from happy to sad)? [d]During the ureteral stent placement period, did you lose interest in doing things? [e]During the ureteral stent placement period, did you feel you no longer enjoyed activities you previously liked?

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that anhedonia constitutes the predominant emotional disturbance among patients with ureteral stents, with approximately three-quarters of patients experiencing significant reductions in hedonic capacity. In contrast, emotional volatility was less frequently reported, though irritability remained a notable concern for nearly half of the patients.

Correlation Analysis Between PROMIS Emotional Distress Dimensions

Pearson correlation analysis revealed significant relationships among various emotional distress dimensions in patients with ureteral stents (Table 7). Strong positive correlations were identified among the core emotional distress dimensions, with depression, anxiety, and psychological distress exhibiting correlation coefficients ranging from 0.713 to 0.765 ($p<0.001$), suggesting substantial comorbidity of these emotional states in stent patients.

The emotional fluctuation indicators demonstrated differential associations with the core distress dimensions. Both anger ($r=0.551$, $p<0.001$) and irritability ($r=0.498$, $p<0.001$) showed moderate correlations with depression. Similarly, these emotional responses correlated significantly with anxiety ($r=0.462–0.473$, $p<0.001$) and psychological distress ($r=0.503–0.571$, $p<0.001$). Notably, mood swings were significantly associated only with psychological distress ($r=0.321$, $p<0.001$) but not with depression or anxiety.

Anhedonia-related symptoms presented a distinct correlation pattern. Loss of interest in activities was significantly associated with anxiety ($r=0.310$, $p<0.001$) and psychological distress ($r=0.382$, $p<0.001$), but not with depression. Conversely, reduced enjoyment of previously pleasurable activities exhibited moderate correlations with all three core emotional distress dimensions ($r=0.453–0.563$, $p<0.001$).

Interestingly, the two categories of emotional responses—emotional fluctuations and anhedonia—showed minimal correlation with each other. Loss of interest did not correlate significantly with anger, irritability, or mood swings, and even showed a negative trend with anger ($r=-0.139$). This suggests that stent-related emotional distress may manifest through two relatively independent pathways: emotional reactivity and reduced hedonic capacity.

Multivariate Analysis

Multiple linear regression analysis was employed to evaluate the relationship between gender and various dimensions of perceived stress in patients with ureteral stents (Table 8). Results revealed significant gender differences in perceived helplessness, with female patients reporting substantially higher levels compared to male patients ($B=-4.905$, $\beta=-0.371$, $p=0.001$). This finding indicates that female patients experienced a stronger sense of lacking control during the stent placement period. In contrast, no significant gender difference was detected in the perceived tension dimension ($B=-0.444$, $\beta=-0.043$, $p=0.698$), suggesting that both genders experienced comparable levels of strain and pressure. The analysis of total perceived stress scores demonstrated that female patients generally reported higher overall stress levels than their male counterparts ($B=-5.349$, $\beta=-0.266$, $p=0.016$), a difference primarily attributed to the disparity in the

Table 7 Pearson Correlation Analysis Between PROMIS Emotional Distress Dimensions and Emotional Fluctuation/Anhedonia Items (n=82)

Variable	1	2	3	4	5	6	7	8
1. Depression	1							
2. Anxiety	0.765**	1						
3. Psychological Distress	0.713**	0.733**	1					
4. Easily angered[a]	0.551**	0.462**	0.503**	1				
5. Easily provoked[b]	0.498**	0.473**	0.571**	0.742**	1			
6. Mood changes[c]	0.176	0.172	0.321**	0.211	0.318**	1		
7. Loss of interest[d]	0.164	0.310**	0.382**	−0.139	−0.020	0.042	1	
8. Reduced enjoyment[e]	0.453**	0.563**	0.463**	0.110	0.173	0.074	0.620**	1

Notes: **$p < 0.01$. [a]During the ureteral stent placement period, did you easily feel angry or irritated? [b]During the ureteral stent placement period, were you easily provoked by minor issues? [c]During the ureteral stent placement period, did you experience dramatic mood changes (eg, from happy to sad)? [d]During the ureteral stent placement period, did you lose interest in doing things? [e]During the ureteral stent placement period, did you feel you no longer enjoyed activities you previously liked?

Table 8 Multiple Linear Regression Analysis of Gender on Perceived Stress Dimensions in Patients with Ureteral Stent

Dimension	B	SE	β	t	P-value
Perceived Helplessness	−4.905	1.374	−0.371	−3.570	0.001**
Perceived Tension	−0.444	1.142	−0.043	−0.389	0.698
Total Perceived Stress	−5.349	2.165	−0.266	−2.471	0.016*

Notes: Gender was coded as female=0, male=1; B=unstandardized regression coefficient; SE=standard error; β=standardized regression coefficient. *p<0.05, **p<0.01.

helplessness dimension. These findings underscore the importance of considering gender as a relevant factor when assessing psychological responses to ureteral stent placement and suggest that interventions targeting feelings of helplessness may be particularly beneficial for female patients.

Discussion

Ureteral stents are widely utilized in the management of upper urinary tract calculi, ureteral strictures or obstructions, urinary tract reconstruction, and renal transplantation procedures. Despite advances in stent materials and design in recent years, their use continues to be associated with patient discomfort, bacterial colonization, hematuria, irritative voiding symptoms, and urinary encrustation.[18] These complications significantly impact treatment outcomes and patients' quality of life.

Current research predominantly focuses on physical discomfort following ureteral stent insertion, while studies investigating psychological aspects and stress responses in stented patients remain limited. This study evaluated the psychological stress and emotional responses in patients with indwelling ureteral stents. Our findings indicate significant gender differences in stent-related stress experience, with variations primarily manifested in the loss of control dimension rather than the tension dimension. Female patients experienced higher levels of loss of control and overall perceived stress.

The observed gender differences in stent-related psychological stress, particularly in the heightened helplessness dimension among women, can be understood through multiple interconnected mechanisms supported by recent evidence. Neurobiologically, women demonstrate distinct hypothalamic-pituitary-adrenal (HPA) axis responses to stress, with research indicating that estrogens sensitize HPA axis responses to stressors and increase basal HPA axis activity.[19,20] While some studies show men exhibit greater HPA activation to psychological stressors, women display more complex hormonal reactivity patterns influenced by menstrual cycle phases.[21,22] From a cognitive-behavioral perspective, gender differences in coping strategies significantly contribute to our findings. Women typically employ more emotion-focused coping strategies compared to men's problem-focused approaches, which may predispose them to experience greater helplessness when confronted with uncontrollable medical stressors like stent-related discomfort.[23,24] Research specifically demonstrates that women score higher on helplessness subscales across various medical contexts, including pain management and assisted reproductive technology procedures.[25–27] This aligns with our observation that women reported significantly higher helplessness scores ($p<0.05$) in our study population. Additionally, multiple social roles assumed by modern women, coupled with cultural influences, contribute to increased vulnerability to mood and anxiety disorders. The negative impact of perceived stress on mental health has been widely recognized.[28,29] These findings suggest that healthcare professionals should pay greater attention to patients' psychological needs in clinical practice, particularly for female patients. Specifically, targeted support and interventions aimed at enhancing patients' sense of control are warranted. Concurrently, these findings provide valuable insights into gender-based differences in symptom experience with ureteral stents and their underlying mechanisms.

Our study did not identify statistically significant associations between demographic characteristics and stent-related psychological dimensions. Although certain trends were observed, such as higher depression scores in patients with bilateral stents and elevated scores across all psychological dimensions among retired individuals, these differences did not reach statistical significance. This may partly reflect limited sample sizes in certain subgroups (eg, retired

participants), potentially resulting in "trend-level differences" rather than conclusive findings. These results suggest that psychological impacts associated with ureteral stents may be relatively consistent across patients with diverse demographic characteristics, indicating that equal psychological attention should be provided to all patient populations in clinical practice. Regarding hedonic capacity and activity interest, the high prevalence of anhedonia symptoms (exceeding 75%) likely reflects both the restrictive effects of stent-related physical discomfort on normal daily activities and its indirect impact on psychological well-being. This primarily manifests as diminished pursuit of recreational activities, potentially leading to reduced interactions with family and friends, resulting in decreased social support—a factor crucial for the rehabilitation process. Concurrently, anhedonia constitutes a core symptom of depression, and its high prevalence suggests clinicians should monitor for potential depressive disorders when managing patients with indwelling stents. In contrast, emotional instability was not identified as a primary psychological manifestation in stent patients.

From the patient perspective, concerns about lower urinary tract symptoms caused by indwelling stents can generate stent-related psychological stress and anxiety, consequently affecting quality of life. Research has proposed that increased negative emotions are associated with elevated expression of proinflammatory and type I IFN genes.[30] Consequently, negative emotional states such as depression and anxiety are linked to immune system function, suggesting that individuals with poorer mental health may be more susceptible to acute and chronic inflammation. For postoperative patients, this may translate to increased infection risk during the stent indwelling period. Additionally, anxiety and depression can heighten sensitivity to physical symptoms, intensifying pain perception and creating a vicious cycle that exacerbates distress during recovery.[31] These findings emphasize that during ureteral stent therapy, clinicians should address patients' psychological well-being alongside physical symptom management, including preoperative psychological education and regular postoperative psychological assessments. These findings have important implications for clinical practice and suggest the need for gender-informed approaches to perioperative psychological care in ureteral stent management. Based on our observations of significant gender differences in helplessness responses and the high prevalence of anhedonia symptoms (>75%), we recommend implementing a comprehensive screening and intervention framework. All patients undergoing ureteral stent placement should receive baseline psychological assessment using validated instruments, with particular attention to helplessness dimensions in female patients and those requiring prolonged stent duration (≥4 weeks). Clinical protocols should incorporate risk stratification strategies that identify high-vulnerability populations, including female patients who demonstrated significantly higher helplessness scores (12.32 ±8.00 vs 4.44±3.37, $p<0.001$) and patients with extended stent indwelling periods. For identified high-risk individuals, evidence-based brief behavioral interventions targeting helplessness cognitions and anhedonia symptoms should be integrated into routine urological care, with consideration for cognitive-behavioral techniques that address emotion-focused coping patterns particularly prevalent among female patients. Specific psychological support and interventions should target anhedonia, while urologists can alleviate psychological discomfort through patient education and addressing concerns. Enhanced collaboration with mental health professionals may better mitigate psychological distress in patients with indwelling stents.

This study has several limitations: it was conducted at a single center with an insufficient sample size; demographic distribution was not stratified, resulting in uneven occupational representation; all enrolled patients received the same type of ureteral stent material, precluding assessment of how different stent materials might influence psychological states; The extended stent duration (86.6% ≥1 month) in our study exceeded the standard 2–4 week recommendation, primarily attributed to several factors: (1) our patient population was predominantly rural-based (51.2% agricultural workers) with geographic remoteness creating transportation barriers; (2) limited cystoscopy suite availability and surgical scheduling constraints requiring extended waiting periods for stent removal procedures; (3) individualized clinical decisions for patients with slower recovery or minor complications; and (4) seasonal factors including influenza outbreaks and Chinese New Year holidays during the study period, leading to rescheduled procedures. While this represents real-world clinical scenarios in rural healthcare settings, it may limit the generalizability of our findings to urban populations with standard stent removal timing; insufficient variability in stent indwelling duration prevented analysis of psychological stress differences between short-term and long-term stent placement; the study was limited to analyzing psychological states in patients with urinary calculi requiring stents, without examining stent effects in other pathological conditions. Future research should expand to multi-center collaborations with comparative analyses of

various stent materials to obtain more reliable data. Our findings contribute to the growing body of evidence supporting gender-informed healthcare approaches. The identification of helplessness as a primary gender-differentiated response to stent placement provides a foundation for developing targeted screening tools and intervention protocols. This research advances our understanding of how medical procedures impact psychological well-being differently across genders, informing the development of more personalized perioperative care strategies in urological practice.

Conclusion

Ureteral stent placement significantly increases psychological stress in patients, particularly in tension and helplessness dimensions.

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Disclosure

The authors declare no competing interests in this work.

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