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The practical value of psychological intervention based on stress response system theory in the perioperative period of thyroid cancer patients

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CITATION

Liu Je, Ma Y, Liang H, et al. The practical value of psychological intervention based on stress response system theory in the perioperative period of thyroid cancer patients. *Psycho-Oncologie*. 2025; 19(4): 3679.
<https://doi.org/10.18282/po3679>

ARTICLE INFO

Received: 10 December 2024

Revised: 5 February 2025

Accepted: 13 February 2025

Available online: 29 October 2025

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Abstract: Objective: This study seeks to probe the practical value of psychological interventions based on stress response system theory in the perioperative care of thyroid cancer patients. **Materials and methods:** A total of 100 patients scheduled for thyroid cancer surgery at Tangshan Workers' Hospital from October 2023 to March 2024 were selected as research subjects, all of whom were confirmed by pathological diagnosis. The 50 patients admitted from October 2023 to December 2023 were assigned to the control group; the 50 patients admitted from January to March 2024 were assigned to the experimental group. Both groups received standard thyroid cancer surgery-related health education, while the observation group was also subjected to psychological interventions based on stress response system theory. Comparisons were made in terms of negative emotions, sleep quality, quality of life, fatigue, self-efficacy, resilience, voice disorder, laryngopharyngeal reflux (LPR) symptoms, health behaviors at three months postoperatively, postoperative pain, and complications between the groups before and after the intervention. **Results:** Following the intervention, the observation group exhibited significantly lower scores on the Self-Rating Anxiety Scale (SAS), Self-Rating Depression Scale (SDS), Pittsburgh Sleep Quality Index (PSQI), Fear of Progression Questionnaire-Short Form (FoP-Q-SF), Quality of Life Questionnaire-Core 30 (QLQ-C30), and Cancer Fatigue Scale (CFS) compared with the control group. Meanwhile, scores on the Chinese version of the Strategies Used by Patients to Promote Health (C-SUPPH), Connor-Davidson Resilience Scale (CD-RISC), and dimensions of health behaviors three months post-surgery were remarkably higher within the observation group. The observation group predominantly adopted coping strategies such as confrontation, while the control group leaned towards resignation and avoidance, with statistically significant differences ($P < 0.05$). **Conclusion:** Psychological interventions rooted in stress response system theory can significantly reduce negative emotions, boost sleep quality and overall quality of life, decrease fatigue, and strengthen resilience among thyroid cancer patients. By fostering healthier behaviors, these interventions support recovery, minimize complications, and improve prognoses.

Keywords: stress response system theory; psychological intervention; thyroid cancer; anxiety; fear

1. Introduction

Thyroid cancer is known as a prevalent malignant tumor of the head and neck, accounting for about 1% of all malignancies systemically [1,2]. Although most thyroid cancers have a good prognosis, anaplastic thyroid cancer (ATC) can invade and metastasize early on, being highly malignant with a poor prognosis [3]. The journey of battling cancer presents not only physiological challenges but also a series of

complicated psychological and social issues. The National Comprehensive Cancer Network (NCCN) emphasizes that cancer-associated psychological issues severely affect treatment outcomes and patients' quality of life [4]. Chinese scholars have also translated this issue as psychological suffering or psychological distress. Surveys indicate that the prevalence of psychological distress among outpatient cancer patients can reach as high as 90% [5].

The concept of stress was first introduced in 1936 by Canadian pathophysiologist Hans Selye. He defined stress as the sum of nonspecific responses produced by the body to various external or internal stimuli. Selye referred to these nonspecific changes, which are not directly related to the stimuli, as the General Adaptation Syndrome (GAS), later renamed stress. Selye proposed that GAS is a universal form of the body's defensive response to harmful stimuli, mediated through the excitation of the pituitary-adrenal cortex axis (later developed into the hypothalamic-pituitary-adrenal axis) [6]. Over the years, research in psychopathology, psychological intervention, and mental health has shown that the relationships between various factors in mind-body issues are not simple cause-and-effect relationships but rather complex and interrelated. According to the "process theory", life events such as a cancer diagnosis are seen as "stressors", and different individuals have varying cognitive appraisals of these stressors, leading to different cognitive styles and response outcomes. Additionally, these factors can also influence the event itself, with cognitive appraisal, coping strategies, and social support acting as intermediate factors in the "process theory". These intermediate factors are subject to mutual influence and constraints from other factors and can serve as both causes and effects. Therefore, the stress system is not a simple stimulus-response process but a comprehensive system involving the interaction of multiple factors [7].

There is a complex relationship of mutual influence between cancer patients and the stress system, manifesting as a vicious cycle. Stress appears to promote cancer progression by activating the sympathetic nervous system to release adrenaline and noradrenaline, as well as activating the hypothalamic-pituitary-adrenal axis to release cortisol. Chronic stress may lead to decreased immune function, weakening anti-tumor capabilities, accelerating tumor growth, and reducing treatment tolerance and efficacy [8]. Stress system theory suggests that fully understanding patients' stressors and providing targeted psychological and behavioral interventions is the foundation for alleviating adverse stress, which has positive implications for helping patients correctly face their disease and treatment [9]. Studies have shown that thyroid cancer patients often exhibit negative emotions during the treatment decision-making process [10]. Further research by Gusakova's team indicates that stress activates thyroid function, leading to increased iodinated thyroid hormone (ICTH) concentrations and elevated anxiety levels in animals. Chemical sympathectomy has no effect on the increase in anxiety in stressed rats, while bilateral adrenalectomy promotes an increase in their anxiety levels [11]. Therefore, the stress system plays a significant role in thyroid cancer patients.

Although thyroid cancer is usually good, patients may still experience significant psychological and social pressure during diagnosis, treatment, and follow-up. Patients often have psychological reactions such as high anxiety, fear, and depression, and the treatment process, such as surgery, radioactive iodine therapy, and lifelong hormone

replacement, may also bring physical discomfort and economic burden [12]. In addition, the sequelae of surgical complications, sound changes, difficulty swallowing, and concerns about the future will affect the quality of life and psychological state of patients, especially for ATC patients [13]. The stress system theory believes that fully understanding the patient's stress source and then giving targeted psychological and behavioral intervention is the basis for alleviating adverse stress, which has a positive effect on helping patients correctly face diseases and treatment [14,15]. Interventions based on stress system theory for thyroid cancer aim to evaluate patients' stress and pressure sources and develop intervention measures to cope with stress and stress responses, featuring personalized characteristics, guiding negative emotions, establishing correct patient perceptions, and improving intervention outcomes [9].

This study seeks to analyze clinical data from thyroid cancer patients to explore the application value of psychological interventions based on stress response system theory during the perioperative period. It is hoped that the findings can provide insights into improving prognosis and psychological therapy for thyroid cancer patients.

2. Subjects and methods

2.1. General data

A total of 100 patients scheduled for thyroid cancer surgery at Tangshan Workers' Hospital from October 2023 to March 2024 were selected as research subjects, all of whom were confirmed by pathological diagnosis. To avoid contamination, the 50 patients admitted from October 2023 to December 2023 were assigned to the control group; the 50 patients admitted from January to March 2024 were assigned to the experimental group. Both groups were asked to receive standard thyroid cancer surgery-related health education, whereas the observation group additionally underwent psychological interventions based on stress response system theory. Among the 100 patients, a total of 92 subjects completed the intervention, with 45 in the control group and 47 in the intervention group. There was no statistically significant difference between the two groups in terms of age, gender, educational level, marital status, insurance type, pathological type, and surgical method ($P > 0.05$). Details are provided in **Table 1**.

Table 1. Comparison of general data between the two groups (n , %) ($\bar{x} \pm s$).

		Control group ($n = 45$)	Observation group ($n = 47$)	t/χ^2	P
Age (years)		46.36 $\pm$ 11.77	47.89 $\pm$ 12.56	-0.605	0.546
Gender	Male	23	16	2.743	0.098
	Female	22	31		
Educational level	Primary School	6	11	1.907	0.592
	Junior High School	20	16		
	High School/Technical Secondary School	5	5		
	Junior College and Above	14	15		

Marital status	Married	30	36	1.118	0.290
	Unmarried	15	11		
Medicare Type	Cash	2	3	3.496	0.174
	Resident Medical Insurance	26	18		
	Employee Medical Insurance	17	26		
Pathological Types	Papillary Carcinoma	24	29	0.779	0.677
	Follicular Carcinoma	21	18		
Surgical Types	Unilateral thyroid lobectomy and isthmus resection	19	20	3.496	0.174
	Total bilateral thyroidectomy	15	12		
	Total bilateral thyroidectomy + neck lymph node dissection	11	15		

2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) Individuals diagnosed through imaging, thyroid function tests, and pathological examination; (2) Individuals who met diagnostic and treatment criteria for thyroid cancer; (3) Individuals who met surgical indications; (4) Expected survival time ≥ 6 months; (5) Informed consent provided; (6) Age between 18 and 70 years; (7) Physical condition of the patient capable of tolerating exercise and rehabilitation.

Exclusion criteria: (1) Patients undergoing radiofrequency ablation or other unconventional surgeries; (2) Patients with hearing, vision, or other communication impairments; (3) Patients currently participating in other preoperative rehabilitation exercises; (4) Presence of other malignant tumors; (5) Severe liver or kidney dysfunction, cardiovascular or neurological disorders; (6) Coagulation disorders; (7) Severe chronic diseases affecting the respiratory or endocrine systems; (8) Incomplete clinical data and patients who were unable to complete the exercises and efficacy evaluations on time.

This study was approved by the Ethics Committee of Tangshan Workers' Hospital ([2023] Ethics Review No.149). All research subjects voluntarily participated in the study and signed informed consent forms.

2.3. Treatment methods

All patients received routine care, including preoperative visits to explain surgical precautions, guiding through routine tests, and preparation for surgery (e.g., skin preparation, fasting), postoperative monitoring of vital signs, administration of medications and infusions as prescribed, and guidance on maintaining a balanced diet and regular exercise. Upon discharge, patients received verbal reminders emphasizing the importance of maintaining a healthy lifestyle and practical advice for sustaining good habits.

In addition to the routine care provided to the control group, the observation group received psychological care based on stress response system theory, as detailed below: 1) Ongoing health education: Upon admission, patients were introduced to the ward environment and educated about thyroid cancer through engaging methods such as PowerPoint presentations, videos, and interactive Q&A sessions. This aimed to help

patients familiarize themselves with the environment, alleviate anxiety and fear, and establish a strong nurse-patient relationship. Postoperative dietary and exercise guidelines were provided using visually appealing manuals, videos, and hands-on demonstrations to ensure understanding. 2) Psychological interventions: A gradual approach was adopted, encouraging patients and their family members to participate and learn together. Frequent communication helped identify psychological issues early, allowing timely interventions to address negative emotions and help patients maintain a stable and positive mindset. 3) Relaxation therapy: Abdominal Breathing: Inhale for 3–5 s, hold for 1 s, exhale for 3–5 s, and hold for 1 s. The entire breathing cycle should be controlled within approximately 15 s. The frequency of this exercise is once per day, with each session of abdominal breathing lasting 20 min; Muscle Relaxation: Begin with the muscles from the face down to the feet, skipping any limbs with movement impairments. During muscle relaxation, combine with abdominal breathing. Inhale while tensing the muscles, and exhale while relaxing them. Each muscle group should be relaxed for about 10 s, followed by a relaxation period of 20–30 s. Throughout this process, patients can experience the sensation of muscle relaxation. Repeat this sequence 2–3 times, once per day, with each session lasting 15 min; Music Relaxation Therapy: During the process, first select light music suitable for the patient, such as classical music or natural sounds, and create a quiet, comfortable environment. The patient should sit or lie down in a comfortable position, close their eyes, and enter a relaxed state through deep breathing. While the music is playing, guide the patient to focus on the music and imagine the imagery it describes, conducting a body scan to relax the muscles. The entire process lasts 15–30 min, after which the patient is slowly guided back to reality. This therapy helps improve the patient's emotional state and sleep quality, promoting overall relaxation and recovery. Meditation: In a distraction-free environment, the patient adopts a comfortable sitting or lying position, maintaining a relaxed posture and focusing attention on their breath, feeling the intake and outflow of air. The nurse may choose soothing songs to help the patient immerse themselves in the experience, explaining the structure of the respiratory system and the basics of breathing, allowing the patient to visualize their own breathing process in their mind. At the end, the patient slowly opens their eyes, stretches their body, and integrates a mindful attitude into their daily life. This technique is performed once per day, with each session lasting 20 min. 4) Emotional and social support: Family members were educated about thyroid cancer and related surgical procedures to enhance their understanding and support capabilities. Patients were encouraged to undertake manageable tasks to strengthen their sense of self-efficacy. Peer interaction sessions were organized, where well-recovered patients shared their experiences, boosting the confidence and motivation of other patients in their treatment journey.

Both the control group and the observation group started interventions one week before surgery and continued until three months after the surgery, ensuring that patients received comprehensive psychological support throughout the preoperative, intraoperative, and postoperative recovery periods. The specific frequencies have already been detailed in the methodology section. The frequency of the interventions was once per day, with each session lasting 15–30 min.

2.4. Observation of indicators

2.4.1. Distress thermometer

The NCCN Distress Management group, along with existing research, advocates the use of the distress thermometer (DT) as an effective screening tool for psychological distress (PD). Developed by Roth, it was initially employed to screen for distress in prostate cancer patients [16]. The DT is known for its ease of use and has been proven effective across various countries and regions, with a recommended critical value of 4 points [17,18]. After a decade of effort, the DT has become widely applied in China. The DT is a self-report tool used to assess the level of psychological distress, rated on a scale from 0 to 10, with 0 signifying no distress and 10 representing the highest level of distress. Patients scoring 4 or higher are recommended for further professional evaluation and treatment. Participants are instructed to indicate the level of distress they have experienced over the past 7 days. The Chinese version of the DT includes 40 items divided into 5 groups (practical concerns, family concerns, emotional problems, physical concerns, and spiritual/religious concerns) (see **Figure 1**). In this study, psychological staff interviewed the thyroid cancer patients, and it was found that among the 92 patients, the overall rate of significant distress attained 13.04%, with distress triggered by emotional issues detected at a rate of 8.70% (see **Figure 2**).

NCCN Distress Thermometer
Psychological distress refers to an unpleasant experience of a psychological, physical, social, or spiritual nature, measured on a scale from 0 to 10. It can affect how you think, feel, or behave. Psychological distress may make it more challenging for patients to cope with cancer, physical symptoms, or treatment.

Question List: Please indicate whether you have experienced the following issues in the past week (including today). For each question, please select either "Yes" or "No".

Extreme distress 10 9 8 7 6 5 4 3 2 1 No distress 0	Yes	No	Practical Concerns	Yes	No	Spiritual or Religious Concerns
	☐	☐	Having time or energy to take care of children	☐	☐	Physical Concerns
	☐	☐	Food	☐	☐	Appearance
	☐	☐	Housing	☐	☐	Bathing/dressing
	☐	☐	Insurance and finances	☐	☐	Breathing
	☐	☐	Transportation	☐	☐	Changes in urination
	☐	☐	Food	☐	☐	Constipation
	☐	☐	Work/study	☐	☐	Diarrhea
	☐	☐	Treatment decisions	☐	☐	Eating
	☐	☐	Family Concerns	☐	☐	Fatigue
	☐	☐	Relationship with children	☐	☐	Feelings of swelling
	☐	☐	Relationship with spouse or partner	☐	☐	Fever
	☐	☐	Ability to have children	☐	☐	Dizziness
	☐	☐	Health issues of family members	☐	☐	Dyspepsia
	☐	☐	Emotional Problems	☐	☐	Memory decline/lack of concentration
	☐	☐	Depression	☐	☐	Oral pain
	☐	☐	Fear	☐	☐	Nausea
	☐	☐	Nervousness	☐	☐	Dry or congested nose
	☐	☐	Sadness	☐	☐	Pain
	☐	☐	Worry	☐	☐	Sex
☐	☐	Loss of interest in daily activities	☐	☐	Dry or itchy skin	
Other Concerns			☐	☐	Sleep	
			☐	☐	Substance use	
			☐	☐	Tingling in hands or feet	

Figure 1. NCCN distress thermometer.

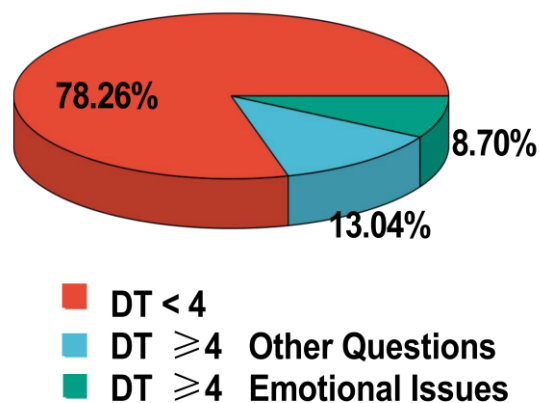


Figure 2. Distress detection rate in thyroid cancer patients.

2.4.2. Comparison of negative emotions before and after intervention in both groups

The Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) [19] were adopted for evaluation, each comprising 20 items scored from 1 to 4 points per item, with higher scores denoting more severe anxiety and depressive symptoms.

The Fear of Progression Questionnaire-Short Form (FoP-Q-SF) [20] was introduced to assess the fear of cancer recurrence (FCR) in both cohorts. This scale encompasses 12 items, with a total score range of 12–60 points; a higher score represents a greater sense of fear.

2.4.3. Comparison of sleep quality, quality of life, and fatigue before and after intervention in the two groups

The Pittsburgh Sleep Quality Index (PSQI) [21] was employed to assess sleep quality over a one-month period preceding and following intervention. This scale comprises 7 items, scored from 0 to 3 points each, with higher scores suggesting poorer sleep quality.

The Quality of Life Questionnaire-Core 30 (QLQ-C30) [22] was taken to evaluate the patients' quality of life three months post-surgery, measuring five dimensions: physical functioning, social functioning, role functioning, emotional functioning, and cognitive functioning, with a total score of 100 points per dimension; higher scores denote better quality of life.

The Cancer Fatigue Scale (CFS) [23] was utilized to assess fatigue levels, with higher scores signifying greater fatigue.

2.4.4. Comparison of resilience preceding and following intervention between the two groups

The Connor-Davidson Resilience Scale (CD-RISC) [24] was adopted to examine psychological resilience prior to and subsequent to the intervention (3 months post-intervention) in both cohorts. The scale consists of three dimensions: tenacity (13 items), optimism (4 items), and strength (8 items), totaling 25 items. Each item on the scale is rated from 0 to 4 points, where higher scores indicate greater resilience.

2.4.5. Comparison of coping strategies preceding and following intervention between the two groups

The Medical Coping Mode Questionnaire (MCMQ) [25] was introduced to assess coping strategies one month preceding and following the intervention in both cohorts. This scale consists of 20 items divided into three dimensions: resignation (5–15 points), avoidance (7–30 points), and confrontation (10–30 points). Each item is scored from 1 to 4 points, and the dimension with the highest score represents the patients' most common coping strategy.

2.4.6. Comparison of voice disorders and laryngopharyngeal reflux (LPR) symptoms before and after intervention in both groups

The Voice Handicap Index (VHI) [26] scale was utilized to analyze the status of voice disorders before and after the intervention in both cohorts of patients. This scale encompasses physiological, functional, and emotional aspects, with a total score range of 0–120 points. Mild voice disorders are scored from 0 to 30 points; moderate voice disorders are scored from 31 to 60 points; severe voice disorders are scored from 61 to 120 points.

The Reflux Symptom Index (RSI) scale [27] was harnessed to examine symptoms prior to and subsequent to the intervention in both cohorts, with a total score range of 0–40 points. A score of 13 or above suggests a positive result. Higher scores denote more severe symptoms.

2.4.7. Comparison of health behaviors three months post-surgery in the two groups

The Health Promoting Lifestyle Profile (HPLP) [28] assisted in the assessment of health behaviors three months following surgery in both groups. The scale consists of 52 items categorized into six dimensions: physical activity, stress management, health responsibility, nutrition, interpersonal relationships, and mental health (each item is scored from 1 to 4 points), with higher scores reflecting better health behaviors.

2.5. Statistical analysis

With the use of SPSS version 20.0 software (SPSS Inc., Chicago, IL, USA), we conducted statistical analysis. Measurement data were represented as mean $\pm$ standard deviation ($\bar{x} \pm s$). Enumeration data were expressed as %. Single-factor analysis was conducted using the χ^2 test, and the independent samples *t*-test was implemented for group comparisons. A *P*-value of less than 0.05 was regarded as statistically significant.

3. Results

3.1. Comparison of negative emotions before and after intervention between the two groups

The results suggested that prior to the intervention, there were no substantial differences in SAS, SDS, and FoP-Q-SF scores between the two cohorts ($P > 0.05$). Nevertheless, following the intervention, the observation cohort exhibited lower SAS, SDS, and FoP-Q-SF scores compared with the control group, with the differences being statistically significant ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of negative emotions before and after intervention between the two groups ($\bar{x} \pm s$).

	Number of cases (<i>n</i>)	SAS		SDS		FoP-Q-SF	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Control group	45	47.98 ± 8.16	45.62 ± 6.29	52.32 ± 8.28	49.56 ± 6.31	34.45 ± 4.35	32.15 ± 4.01
Observation group	47	47.82 ± 8.21	40.54 ± 6.15	52.36 ± 8.45	41.46 ± 6.06	34.36 ± 4.32	27.64 ± 3.86
<i>t</i>		0.094	3.945	0.023	6.281	0.100	5.500
<i>P</i>		0.925	< 0.001	0.982	< 0.001	0.921	< 0.001

3.2. Comparison of sleep quality, quality of life, and fatigue before and after intervention in the two groups

As indicated by the results, preceding the intervention, no remarkable variances were discovered in PSQI, QLQ-C30, and CFS scores between the two cohorts of patients ($P > 0.05$). However, subsequent to the intervention, lower PSQI scores (7.15 ± 1.51) were observed in the observation group as opposed to the control group (8.64 ± 1.36). QLQ-C30 scores (89.56 ± 8.56) were also higher within the observation group versus the control group (75.46 ± 8.07). CFS scores (11.15 ± 1.57) were lower than those within the control group (17.64 ± 1.86). These differences were considered statistically significant ($P < 0.05$), as presented in **Table 3**.

Table 3. Sleep quality, quality of life, and fatigue in the two groups ($\bar{x} \pm s$).

	Number of cases (<i>n</i>)	PSQI		QLQ-C30		CFS	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Control group	45	12.36 ± 2.13	8.64 ± 1.36	48.95 ± 9.28	75.46 ± 8.07	36.48 ± 4.57	17.64 ± 1.86
Observation group	47	12.25 ± 2.21	7.15 ± 1.51	48.36 ± 9.25	89.56 ± 8.56	36.36 ± 4.39	11.15 ± 1.57
<i>t</i>		0.243	4.966	0.305	8.122	0.128	18.114
<i>P</i>		0.809	< 0.001	0.761	< 0.001	0.898	< 0.001

3.3. Comparison of resilience preceding and following intervention between the two groups

Prior to the intervention, there were no statistically significant variances in the CD-RISC dimensions (including tenacity, optimism, and strength) between the two cohorts ($P > 0.05$). After the intervention, scores in all CD-RISC dimensions showed an increase compared to pre-intervention levels, with the observation group scoring higher than the control group. These differences were statistically significant ($P < 0.05$), as shown in **Table 4**.

Table 4. Resilience before and after intervention in the two groups ($\bar{x} \pm s$).

	Number of cases (<i>n</i>)	Tenacity		Strength		Optimism	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Control group	45	22.38 ± 3.05	26.68 ± 3.58	17.84 ± 3.54	21.45 ± 2.65	8.63 ± 2.03	10.64 ± 2.12

Observation group	47	21.34 ± 3.12	32.15 ± 3.64	17.85 ± 3.43	26.87 ± 2.68	8.51 ± 2.14	16.58 ± 2.24
<i>t</i>		1.616	7.264	0.014	9.750	0.276	13.052
<i>P</i>		0.110	< 0.001	0.989	< 0.001	0.783	< 0.001

3.4. Comparison of coping strategies preceding and following intervention between the two groups

Preceding the intervention, we found no statistically significant differences in the coping strategy dimensions (including resignation, avoidance, and confrontation) between the two cohorts ($P > 0.05$). Following the intervention, it was discovered that the most common coping strategy of the observation group was confrontation, whereas within the control group, the most common coping strategies were resignation and avoidance. The difference held statistical significance ($P < 0.05$). See **Table 5**.

Table 5. Coping strategies preceding and following intervention in the two groups ($\bar{x} \pm s$).

	Number of cases (<i>n</i>)	Resignation		Avoidance		Confrontation	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Control group	45	10.25 ± 2.32	10.22 ± 2.34	17.54 ± 3.54	16.45 ± 2.25	17.66 ± 2.21	17.36 ± 2.33
Observation group	47	10.34 ± 2.26	8.33 ± 2.21	17.42 ± 3.43	10.33 ± 2.28	17.83 ± 2.34	22.54 ± 2.56
<i>t</i>		0.188	3.984	0.165	12.953	0.360	10.136
<i>P</i>		0.851	< 0.001	0.869	< 0.001	0.721	< 0.001

3.5. Comparison of voice disorders and LPR symptoms before and after intervention in both groups

The results reflected no statistically significant variances in the scores for voice disorders and LPR symptoms between the two cohorts preceding the intervention ($P > 0.05$). Subsequent to the intervention, both groups exhibited lowered scores for voice disorders and LPR symptoms compared with pre-intervention levels, with the observation cohort showing lower scores than the control group. The difference held statistical significance ($P < 0.05$), as seen in **Table 6**.

Table 6. Comparison of voice disorders and LPR symptoms before and after intervention in both groups ($\bar{x} \pm s$).

	Number of cases (<i>n</i>)	Voice disorders						LPR symptom scores	
		Physiology		Function		Emotion		Pre-intervention	Post-intervention
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention		
Control group	45	32.14 ± 2.07	25.23 ± 0.41	34.51 ± 2.25	23.41 ± 0.35	30.46 ± 2.16	25.34 ± 0.41	21.87 ± 1.26	19.97 ± 0.24
Observation group	47	32.21 ± 2.05	20.31 ± 0.52	34.42 ± 2.13	19.36 ± 0.41	30.52 ± 2.21	21.87 ± 0.43	21.83 ± 1.31	13.65 ± 0.25
<i>t</i>		0.163	51.250	0.197	50.854	0.131	39.581	0.149	123.602
<i>P</i>		0.871	< 0.001	0.844	< 0.001	0.896	< 0.001	0.882	< 0.001

3.6. Comparison of health behaviors three months post-surgery between the two groups

The findings denoted that, three months post-surgery, the observation cohort displayed higher scores in all dimensions of health behavior (including physical activity, stress management, health responsibility, nutrition, interpersonal relationships, and mental health) compared with the control group. The difference was found to be statistically significant ($P < 0.05$), as revealed in **Table 7**.

Table 7. Comparison of health behaviors three months post-surgery between the two groups ($\bar{x} \pm s$).

	Number of cases (<i>n</i>)	Physical activity	Stress management	Health responsibility	Nutrition	Interpersonal relationships	Mental health
Control group	45	11.23 ± 2.09	20.84 ± 2.35	15.46 ± 3.21	12.45 ± 2.51	18.23 ± 2.17	14.77 ± 1.27
Observation group	47	15.34 ± 2.14	23.36 ± 2.16	19.87 ± 3.15	15.64 ± 2.19	21.67 ± 2.15	18.34 ± 1.42
<i>t</i>		9.314	5.358	6.650	6.503	7.637	12.691
<i>P</i>		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

4. Discussion

Thyroid cancer patients primarily undergo surgical treatment, but surgery, being a significant life stressor, brings considerable psychological strain due to factors such as the uncertainty of outcomes, economic burden, and disruption of daily routines. These factors often result in mental states like anxiety, depression, and pessimism [29–31]. Research has unraveled that head and neck cancer patients display considerable psychological distress during diagnosis and treatment, but this issue often goes unrecognized [32]. Common emotions for patients and their families battling cancer include anxiety, fear, insecurity, anger, and sadness—normal reactions when dealing with the stress of a cancer diagnosis. With the growing adoption of the “bio-psycho-social” model in modern medicine, more psychological interventions are being implemented for thyroid cancer patients undergoing surgery, leading to promising results. Psychosocial interventions based on stress response system theory are distinguished by their psychodynamics foundation. These interventions effectively assess stressors, determine targeted strategies based on patient feedback, and provide comprehensive psychological support through active listening, explanations, emotional interventions, psychological suggestions, and family support. This approach helps patients feel secure and respected while tapping into their inner strength and potential, enabling them to better cope with the difficulties and setbacks of the disease and surgery and boosting their confidence in recovery [33,34]. Our study’s findings denoted that, post-intervention, the observation group showed notably lowered scores in anxiety and depression, along with a reduced incidence of complications compared with the control group. This hints that psychological intervention can alleviate negative emotions, mitigate physical and psychological stress responses, reduce postoperative complications, and promote recovery. Depression and anxiety are common psychological challenges for cancer patients. A study by Dutch scholars in 2014 unveiled that the average depression prevalence among cancer patients during treatment ranged from 8% to 24% [35]. Similarly,

anxiety and depression in thyroid cancer patients are negatively correlated with their quality of life [36]. Our research demonstrated that, post-intervention, the observation cohort displayed lower SAS, SDS, and FoP-Q-SF scores vis-à-vis the control group, with statistical significance ($P < 0.05$), indicating that stress response theory-based psychological intervention effectively mitigates anxiety, depression, and fear in patients.

Quality of life is a commonly utilized indicator for evaluating the living conditions of cancer patients. Our study further demonstrated that stress response theory-based psychological interventions, by thoroughly analyzing patients' stressors, can design tailored services in areas such as environment, psychology, education, and support that meet the actual needs of patients. This approach helps to channel negative emotions, build confidence in overcoming the disease, enhance cognitive levels, facilitate the successful completion of surgery, promote postoperative recovery, attenuate postoperative pain, and improve quality of life. In line with our findings, Lin et al. [37] discovered that health psychological interventions focusing on knowledge, behavior, and belief improved the quality of life of thyroid cancer patients. Furthermore, the outcomes confirmed that following the intervention, the observation group had lower PSQI and FoP-Q-SF scores compared with the control group, signifying that stress response theory-based psychological interventions are more efficacious in boosting sleep quality and reducing FCR compared with conventional interventions. The underlying reason may be that stress response theory-based psychological interventions are grounded in assessing the intensity of patients' stressors, cognitive appraisals, and psychological status. These interventions aim to improve patients' understanding of their condition and related surgical procedures through continuous health education, ensuring that they have a clear grasp of their condition. Additionally, relaxation training and psychological interventions help ameliorate negative emotions and reduce FCR. The inclusion of social support from family members and peer patients can further optimize the patients' mental well-being, bolstering both FCR and sleep quality [38–40]. Moreover, Silva et al. [41,42] applied interventions based on stress response system theory and revealed that patients with schizophrenia experienced improved resilience. Our study further showed that post-intervention, the CD-RISC scores of the observation group were higher compared to the control group. This indicates that psychological interventions based on stress response theory can effectively boost patients' resilience, which is consistent with previous research.

Thyroid cancer itself is a source of stress and an acute stress event for patients, triggering intense physical and psychological stress responses. Additionally, surgical trauma and potential changes in appearance and voice can also be stressors, leading to shifts in behavior and coping strategies. Here, the observation group presented with lower scores for resignation and avoidance strategies and higher scores for confrontation compared with the control group. Moreover, after the intervention, the observation group scored higher on health behavior scales related to stress coping and health responsibility in contrast with the control group. This suggests that stress response theory-based psychological intervention can improve patients' coping strategies and enhance their health behaviors. The reason for this could be that stress response theory-based psychological intervention, built on a thorough assessment of

thyroid cancer patients' cognitive status, psychological condition, and social support, involves a series of targeted measures. Specifically, emotional regulation technology such as mindfulness meditation and relaxation training helps patients to reduce anxiety and depression and enhance emotional stability; cognitive reconstruction has reduced patients' fear and unnecessary concerns through challenging negative thinking and rebuilding. Improving confidence and adaptability to treatment; response strategies, such as problem solving skills and enhanced social support, enable patients to respond to various challenges in surgery and rehabilitation, thereby enhancing self-efficacy and psychological recovery. These interventions improved the patient's emotional state and quality of life, reduced the occurrence of postoperative complications, and eventually helped patients better recover and return to normal life [43,44].

In summation, psychological intervention based on stress response system theory can effectively ameliorate negative emotions in patients, boost sleep quality and overall quality of life, attenuate fatigue, strengthen self-efficacy and psychological resilience, and mitigate voice disorders and LPR symptoms. By fostering healthy behaviors, it aids in patient recovery, reduces complications, and promotes better outcomes, making it valuable for clinical application. Nonetheless, due to the limitations in sample size, further research is necessary to deepen the understanding of the effectiveness of stress response system theory-based psychological interventions. Future studies will consider enlarging the sample size and prolonging intervention duration to better observe its practical value.

Author contributions: Conceptualization, JeL, YM and HL; execution, JeL, YM, YH and WZ; data collection and analysis, YM, HL, YH, WZ and HC; writing—original draft preparation, JeL, YM, YH, WZ and HC; writing—review and editing, JeL, YM, HL, YH, WZ and HC. All authors have read and agreed to the published version of the manuscript.

Ethical approval: The study was approved by Ethics Committee of Tangshan Workers hospital, complies with the Declaration of Helsinki, (Approval number: No. (149) for Clinical Research ([2023]). The date of approval is [28th December, 2023]. All participants signed the informed consent in this study.

Informed consent statement: Informed consent was obtained from all subjects involved in the study.

Funding: This study has received funding support from the Hebei Provincial Medical Science Research Project (20231787).

Availability of data and materials: The datasets used during the current study are available from the corresponding author upon reasonable request.

Conflict of interest: The authors declare no conflict of interest.

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