

Article

The utility of structure-process-outcome informed psychosocial nursing for lung cancer patients with brain metastases and anxiety

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Abstract: **AIM:** To investigate the application value of psychological support based on the Structural-Process-Outcome three-dimensional quality analysis framework for patients with lung cancer brain metastasis and anxiety. **Methods:** Using the random number table method, 55 patients with lung cancer brain metastasis admitted to Xing'an League People's Hospital from January 2020 to December 2023 were randomly divided into an observation group (28 cases) and a control group (27 cases). The control group received routine continuous nursing intervention measures; the observation group, in addition to the control group's measures, received psychological support under the framework of the Structural-Process-Outcome three-dimensional quality analysis. Both groups of patients were followed up for 20 weeks. The differences in psychological state scores, quality of life levels, and nursing satisfaction between the two groups before and after nursing intervention were compared. **Results:** After 20 weeks of nursing intervention, the GAD-7 and SPBS scores in the emotional, physical, and economic dimensions of the observation group were lower than those of the control group ($P < 0.05$), and the EORTC QLQ-C30 scores in the physical, role, emotional, cognitive, and social functional domains were higher than those of the control group ($P < 0.05$), while the fatigue, pain, and nausea and vomiting symptom domains were lower than those of the control group ($P < 0.05$). The nursing intervention satisfaction was 100.00%, higher than the control group's 81.48% ($P < 0.05$). **Conclusion:** Psychological support, guided by the structural-process-outcome three-dimensional quality analysis framework, can effectively improve the psychological well-being and quality of life in patients with lung cancer brain metastasis and anxiety. Moreover, it significantly enhances nursing satisfaction, underscoring its clinical value

Keywords: Structural-process-outcome; three-dimensional quality analysis; psychological support; lung cancer brain metastasis; anxiety

1. Introduction

Lung cancer is a highly malignant and invasive neoplasm, ranking among the most prevalent malignancies worldwide. Despite significant efforts to curb its spread, the incidence and mortality rates of lung cancer continue to rise, driven by factors such as environmental pollution and unhealthy lifestyle choices [1]. Lung cancer is characterized by rapid cellular proliferation, leading to the destruction of pulmonary tissue and the spread of cancer cells through the bloodstream or lymphatic system, with brain metastasis being one of the most perilous routes of dissemination [2–3]. The disease's aggressive nature is characterized by rapid cellular proliferation and early metastatic potential, making it particularly difficult to manage in advanced stages. Despite significant advancements in diagnostic techniques and therapeutic interventions over the past decade, the incidence and mortality rates of lung cancer

have shown an alarming upward trend, particularly in developing nations. This troubling pattern is largely attributed to a complex interplay of environmental factors, including prolonged exposure to air pollution, occupational hazards, and the persistent prevalence of tobacco use. Furthermore, emerging evidence suggests that lifestyle factors such as sedentary behavior, poor dietary habits, and chronic stress may contribute to the disease's pathogenesis and progression. The global burden of lung cancer is further compounded by its late-stage presentation in many cases, with approximately 70% of patients being diagnosed at advanced stages when curative treatment options are limited.

The metastatic spread of lung cancer, particularly to the brain, represents one of the most devastating complications of the disease, significantly impacting both survival outcomes and quality of life. Brain metastases occur in approximately 30%–40% of lung cancer patients, with certain subtypes such as small cell lung cancer and adenocarcinoma demonstrating particularly high predilection for central nervous system involvement. The pathophysiology of brain metastasis involves a complex cascade of events, including primary tumor cell intravasation, survival in circulation, extravasation through the blood-brain barrier, and subsequent colonization of brain tissue. This process leads to the destruction of neural architecture and disruption of normal brain function, manifesting as a constellation of severe neurological symptoms. Patients frequently experience debilitating headaches, persistent nausea and vomiting, visual disturbances, focal neurological deficits such as limb weakness, and in advanced cases, altered consciousness or cognitive impairment. The presence of brain metastases not only signifies a more advanced stage of disease but also presents unique therapeutic challenges due to the blood-brain barrier's protective mechanisms, which limit the efficacy of many systemic treatments. Moreover, the prognosis for patients with lung cancer brain metastasis remains particularly grim, with median survival times ranging from 6 to 12 months despite aggressive treatment, underscoring the urgent need for more effective therapeutic strategies and comprehensive supportive care approaches [4].

In the context of these clinical challenges, the psychological impact of lung cancer brain metastasis on patients has emerged as a critical area of concern in comprehensive cancer care. The diagnosis of brain metastasis often triggers profound psychological distress, with studies indicating that up to 70% of affected patients experience clinically significant levels of anxiety and depression. This psychological burden is multifaceted, stemming from the fear of neurological deterioration, concerns about treatment side effects, and the existential distress associated with a life-limiting diagnosis [5]. The interplay between psychological distress and disease progression is particularly concerning, as chronic anxiety has been shown to negatively impact treatment adherence, immune function, and overall quality of life. Furthermore, the neurological symptoms associated with brain metastasis can exacerbate psychological distress, creating a vicious cycle that complicates clinical management. Recognizing this critical need, our study introduces a novel Structural-Process-Outcome quality analysis framework to systematically implement and evaluate psychological support interventions for patients with lung cancer brain metastasis and associated anxiety. This comprehensive approach aims to address the complex interplay between physical symptoms and psychological distress, with the ultimate goal of improving both clinical

outcomes and patient quality of life. By integrating evidence-based psychological interventions with standard oncological care, we seek to establish a model of holistic patient management that acknowledges the profound impact of psychological factors on disease progression and treatment outcomes in this vulnerable patient population.

2. Materials and methods

2.1. Study participants

A total of 55 patients diagnosed with lung cancer and brain metastasis, who were admitted to the Department of Oncology at Xing'an League People's Hospital between January 2020 and December 2023, were enrolled in this study. The participants were randomly assigned to either the observation group (28 patients) or the control group (27 patients) using a computer-generated random number table, ensuring an unbiased allocation process. The randomization sequence was concealed using sequentially numbered, opaque, sealed envelopes to maintain allocation concealment. The inclusion criteria were strictly defined to ensure the homogeneity of the study population: (1) histologically or cytologically confirmed primary lung cancer with radiologically confirmed brain metastasis through MRI or CT imaging; (2) presence of clinically significant anxiety symptoms as measured by a Hospital Anxiety and Depression Scale (HADS) anxiety subscore of ≥ 8 ; (3) stable vital signs with systolic blood pressure maintained between 90-140 mmHg and heart rate between 60-100 beats per minute; (4) clear consciousness with a Mini-Mental State Examination (MMSE) score ≥ 24 ; (5) voluntarily signed informed consent after thorough explanation of the study protocol. To maintain the integrity of the study, exclusion criteria were carefully implemented: (1) presence of other severe organic diseases such as NYHA class III or IV heart failure, Child-Pugh class B or C liver cirrhosis, or chronic kidney disease stage 4 or 5; (2) history of diagnosed mental illness or cognitive impairment documented in medical records; (3) history of drug or alcohol dependence within the past 5 years; (4) withdrawal from the study midway due to any reason. Both groups underwent detailed medical history interviews, physical examinations, neurological examinations, and necessary auxiliary examinations before enrollment. The general data were comparable ($P > 0.05$), indicating comparability. See **Table 1**.

Table 1. General data ($\bar{x} \pm s$) / (n (%)).

Group	n	Gender (n/%)		Old (year)	Stroke type (n/%)		
		Male	Female		Small cell lung cancer	Squamous carcinoma	Adenocarcinoma
Observation	28	18 (64.29)	10 (35.71)	62.53 $\pm$ 4.76	14 (50.00)	10 (35.71)	4 (14.29)
Control	27	17 (62.96)	10 (37.04)	62.24 $\pm$ 4.59	14 (51.85)	9 (33.33)	4 (14.81)
<i>t</i>	-	0.010		0.230	0.034		
<i>P</i>	-	0.919		0.819	0.983		

2.2. Research methods

2.2.1. Standard treatment

Both groups of patients received standardized chemotherapy, radiotherapy,

targeted therapy, and symptomatic supportive treatment according to their actual conditions. The chemotherapy regimens were selected based on the type and stage of cancer, with adjustments made for individual tolerance and response. Radiotherapy was administered using precise imaging techniques to target tumor sites while minimizing damage to surrounding healthy tissues. Targeted therapy involved the use of specific drugs designed to inhibit the growth of cancer cells by interfering with molecular targets. Symptomatic supportive treatment included pain management, nutritional support, and psychological counseling to improve the overall quality of life. Regular monitoring and follow-up were conducted to assess treatment efficacy and make necessary adjustments.

2.2.2. Control group interventions

Patients in the control group were provided with routine continuous nursing interventions, including: (1) Regular health education to deepen understanding of the disease, treatment plans, and potential side effects, enhancing self-management capabilities; (2) Daily living care guidance encompassing diet, exercise, medication, and sleep management to establish healthy lifestyle habits; (3) Psychological support through listening, encouragement, comfort, emotional management, and relaxation training to alleviate anxiety and bolster confidence in facing the disease; (4) Establish a good doctor-patient communication QQ work group to regularly answer questions and resolve doubts, ensuring that patients can obtain medical information in a timely manner; (5) Encouragement of participation in patient-friend exchange activities to strengthen social support and confidence in coping with the disease.

2.2.3. Observation group interventions

Building on the control group's interventions, patients in the observation group received psychological support under the Structural-Process-Outcome three-dimensional quality analysis framework, including: (1) Comprehensive Assessment: A thorough evaluation of the patient's disease progression, psychological state, and family situation to understand emotional fluctuations, psychological pressures, anxiety levels, and their needs, expectations, and concerns regarding treatment, laying the foundation for good doctor-patient communication and collaboration; (2) Structural Analysis: Formation of a psychological support team comprising oncologists, nursing staff, psychological counselors, and family members to develop personalized psychological support plans, clarifying roles such as oncologists providing professional medical advice and treatment plans, nursing staff closely monitoring daily needs and providing meticulous care, psychological counselors offering emotional support and psychological counseling, and family members learning daily home care skills and providing emotional support; (3) Process Management: Continuous nursing record-keeping and monitoring during the implementation of psychological support to ensure appropriate execution of care measures. Regular home visits and phone calls monitor home care situations, and team members hold regular meetings to assess the patient's psychological state and the execution of the nursing plan, adjusting strategies to meet changing needs (Psychological support encompasses the following interventions: (1) Emotional counseling: Engaging in one-on-one communication with patients to help them express and manage emotional issues. (2) Social support: Providing information and resources about social support systems to assist patients in

obtaining support during times of helplessness. (3) Psychological education: Introducing patients to disease-related knowledge and treatment processes to enhance their understanding and cooperation with therapy. These interventions are conducted once a week, lasting approximately 30 minutes each, with the entire intervention process spanning 12 weeks.); (4) Outcome Evaluation: Regular assessments of psychological state and quality of life to monitor changes and improvements, evaluating the effectiveness of psychological support; (5) Continuous Improvement: Adjustment of the psychological support plan based on evaluation results to ensure ongoing effective psychological support.

2.2.4. Follow-up observation period

The follow-up observation period for both groups of patients was 20 weeks.

2.3. Evaluation criteria

Comparison of the differences in psychological status scores, quality of life levels, and nursing satisfaction between the two groups before and after nursing intervention.

2.3.1. Psychological status

The Generalized Anxiety Disorder 7 (GAD-7) and the Self-perceived burden Scale (SPBS) were used to assess patients before and after 20 weeks of nursing intervention. The GAD-7 questionnaire primarily evaluates the perception of anxiety symptoms, including the frequency and intensity of anxiety emotions, with seven items rated on a 4-point scale (0 = “never”, 1 = “sometimes”, 2 = “often”, 3 = “almost always”), with a total score ranging from 0 to 21, where higher scores indicate more severe anxiety symptoms. The SPBS assesses the subjective perception of the burden of disease, including emotional (5 items), physical (3 items), and economic (2 items) aspects, each rated on a 4-point scale, with a total score ranging from 0 to 30, where higher scores indicate a greater perceived burden of disease. The SPBS, a multidimensional scale specifically designed for assessing disease-related burden in chronically ill patients, was utilized to evaluate patients’ subjective perception of their disease burden. This comprehensive scale comprises three distinct domains: emotional burden (5 items), physical burden (3 items), and economic burden (2 items). Each item is rated on a 4-point scale, with the total score ranging from 0 to 30. Higher scores on the SPBS indicate a greater perceived burden of disease. The emotional burden subscale captures feelings of guilt, dependency, and emotional distress related to the illness; the physical burden subscale assesses limitations in daily activities and physical discomfort; while the economic burden subscale evaluates financial strain and resource utilization. The SPBS has demonstrated good reliability (Cronbach’s $\alpha = 0.85$) and validity in previous studies involving cancer populations, making it particularly appropriate for assessing the multifaceted burden experienced by patients with lung cancer brain metastasis.

2.3.2. Quality of life (QoL)

QoL was assessed using the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30), a validated and widely utilized tool in oncology research. This comprehensive instrument was administered

to patients before and after a 20-week nursing intervention to evaluate changes in their QoL. The EORTC QLQ-C30 measures multiple dimensions of health-related quality of life, including five functional domains (physical, role, emotional, cognitive, and social) and three symptom domains (fatigue, pain, and nausea/vomiting). Each domain consists of several items designed to capture specific aspects of the patient's experience. Responses are recorded on a 6-point Likert scale (0 = "no problem" to 5 = "severe problem"), with raw scores transformed and standardized to a 0-100 scale for interpretation. Higher scores in functional domains indicate better functioning and QoL, while higher scores in symptom domains reflect greater symptom severity.

The functional domains assess physical capabilities, role performance, emotional well-being, cognitive function, and social interactions, while the symptom domains evaluate fatigue, pain, and nausea/vomiting. Additionally, the questionnaire includes six single items addressing dyspnea, insomnia, appetite loss, constipation, diarrhea, and financial impact. This multidimensional approach provides a holistic evaluation of patients' QoL, capturing both the positive effects of improved functioning and the negative impact of disease-related symptoms. The EORTC QLQ-C30's robust design and standardized scoring make it a reliable tool for assessing the effectiveness of nursing interventions in improving the quality of life for patients with lung cancer brain metastasis.

2.3.3. Nursing satisfaction

After 20 weeks of nursing intervention, satisfaction was evaluated using an anonymous questionnaire survey. The satisfaction questionnaire encompassed multiple dimensions of nursing care, including: 1) technical competence of nursing staff (e.g., skill in performing procedures, medication administration), 2) interpersonal aspects of care (e.g., communication skills, empathy, emotional support), 3) accessibility and responsiveness of nursing services, 4) quality of patient education and information provision, and 5) overall coordination of care. Each dimension was assessed through multiple items using a 5-point Likert scale, with an additional open-ended section for qualitative feedback. The final satisfaction outcome was categorized into three levels: "very satisfied" (indicating excellent care across all dimensions), "satisfied" (indicating generally good care with minor areas for improvement), and "dissatisfied" (indicating significant concerns or unmet needs in one or more aspects of care).

2.4. Statistical methods

Data were processed using SPSS 22.0, with categorical data expressed as percentages (%) and subjected to χ^2 tests; continuous data, which were normally distributed as confirmed by Shapiro-Wilk tests, were expressed as $\bar{x} \pm s$ and compared using *t*-tests, with statistical significance defined as $P < 0.05$.

3. Results

3.1. Comparison of psychological status

Table 2 presents the comparison of psychological status scores between the observation and control groups before and after the 20-week intervention period. At

baseline, both groups showed comparable scores on the Generalized Anxiety Disorder-7 (GAD-7) and all subscales of the self-perceived burden scale (SPBS), including emotional, physical, and economic burden (all $P > 0.05$). Following the intervention, the observation group demonstrated significantly greater improvements compared to the control group, with lower post-intervention scores in GAD-7 (5.98 ± 1.24 vs. 7.31 ± 1.77 , $P = 0.002$), SPBS-emotional (8.67 ± 1.43 vs. 10.25 ± 1.96 , $P = 0.001$), SPBS-body (5.39 ± 1.02 vs. 6.45 ± 1.11 , $P = 0.001$), and SPBS-economy (2.76 ± 0.65 vs. 3.19 ± 0.78 , $P = 0.030$).

Table 2. Comparison of psychological status scores between the two groups (score, $\bar{x} \pm s$).

Group	n	GAD-7		SPBS-emotional		SPBS-body		SPBS-economy	
		Before	After	Before	After	Before	After	Before	After
Observation	28	13.84 $\pm$ 3.17	5.98 $\pm$ 1.24	16.52 $\pm$ 2.73	8.67 $\pm$ 1.43	9.83 $\pm$ 1.65	5.39 $\pm$ 1.02	4.92 $\pm$ 0.85	2.76 $\pm$ 0.65
Control	27	13.76 $\pm$ 3.05	7.31 $\pm$ 1.77	16.34 $\pm$ 2.59	10.25 $\pm$ 1.96	9.76 $\pm$ 1.42	6.45 $\pm$ 1.11	5.06 $\pm$ 0.92	3.19 $\pm$ 0.78
<i>t</i>	-	0.095	3.237	0.251	3.424	0.168	3.690	0.586	2.224
<i>P</i>	-	0.924	0.002	0.803	0.001	0.867	0.001	0.560	0.030

3.2. Comparison of EORTC QLQ-C30 scores for quality of life

There were no statistically significant differences in the scores of the EORTC QLQ-C30 quality of life domains between the two groups before nursing intervention ($P > 0.05$). After 20 weeks of nursing intervention, the GAD-7 and SPBS scores in the emotional, physical, and economic dimensions of the observation group were lower than those of the control group ($P < 0.05$), and the EORTC QLQ-C30 scores in the physical, role, emotional, cognitive, and social functional domains were higher than those of the control group ($P < 0.05$), while the fatigue, pain, and nausea and vomiting symptom domains were lower than those of the control group ($P < 0.05$). See **Table 3**.

Table 3. Comparison of EORTCQLQ-C30 scores of the two groups (n , $\bar{x} \pm s$).

Group	n	Body		Role		Emotion		Cognition	
		Before	After	Before	After	Before	After	Before	After
Observation	28	47.74 $\pm$ 5.18	61.55 $\pm$ 6.39	50.24 $\pm$ 5.61	67.47 $\pm$ 6.32	45.24 $\pm$ 4.79	62.14 $\pm$ 6.55	49.23 $\pm$ 4.85	56.44 $\pm$ 5.57
Control	27	48.09 $\pm$ 5.24	57.43 $\pm$ 6.12	50.37 $\pm$ 5.82	63.36 $\pm$ 6.18	45.67 $\pm$ 4.88	57.26 $\pm$ 6.30	49.75 $\pm$ 4.91	52.74 $\pm$ 5.33
<i>t</i>	-	0.249	2.440	0.084	2.437	0.330	2.814	0.395	2.515
<i>P</i>	-	0.804	0.018	0.933	0.018	0.743	0.007	0.694	0.015
Group	n	Social		Fatigue		Pain		Nausea and vomiting	
		Before	After	Before	After	Before	After	Before	After
Observation	28	48.66 $\pm$ 4.35	57.23 $\pm$ 5.64	46.24 $\pm$ 3.58	36.25 $\pm$ 3.13	58.48 $\pm$ 5.57	44.32 $\pm$ 5.13	76.22 $\pm$ 6.57	52.11 $\pm$ 5.83
Control	27	48.78 $\pm$ 4.42	54.21 $\pm$ 5.09	45.67 $\pm$ 3.94	39.57 $\pm$ 3.36	57.84 $\pm$ 5.69	48.67 $\pm$ 5.44	75.38 $\pm$ 6.64	60.36 $\pm$ 5.98
<i>t</i>	-	0.101	2.082	0.562	3.793	0.422	3.052	0.472	5.181
<i>P</i>	-	0.920	0.042	0.577	<0.001	0.675	0.004	0.639	<0.001

3.3. Comparison of nursing satisfaction

The nursing intervention satisfaction in the observation group was 100.00%, which was higher than the 81.48% in the control group ($P < 0.05$). See **Table 4**.

Table 4. Comparison of nursing satisfaction between the two groups (n/%).

Group	n	Very satisfied	satisfaction	dissatisfy	Overall satisfaction
Observation	28	18 (64.29)	10 (35.71)	0 (0.00)	28 (100.00)
Control	27	7 (25.93)	15 (55.56)	5 (18.52)	22 (81.48)
<i>t</i>	-	-	-	-	5.704
<i>P</i>	-	-	-	-	0.017

4. Discussion

Lung cancer continues to be one of the most challenging and intractable medical issues in China, with incidence and mortality rates consistently ranking among the highest of all cancers [6,7]. As lung cancer progresses to advanced stages, cancer cells can spread and invade the brain through the bloodstream or lymphatic system, forming intracranial metastatic lesions and further complicating treatment and survival challenges for patients. The occurrence of brain metastasis in lung cancer can lead to increased intracranial pressure, triggering a series of brain dysfunctions such as hydrocephalus, and in particularly severe cases, it can even result in paralysis or coma [8,9]. This not only poses a significant threat to patients' physical health but also markedly reduces their quality of life, imposing a heavy psychological and economic burden on patients and their families [10]. Consequently, most patients with lung cancer brain metastasis often experience varying degrees of psychological stress and anxiety, necessitating comprehensive psychological intervention and nursing support.

The psychological impact of lung cancer brain metastasis is particularly profound, as patients frequently experience heightened levels of psychological stress, anxiety, and depression. The combination of physical symptoms, such as headaches, seizures, and neurological deficits, with the emotional toll of a life-threatening diagnosis, creates a complex clinical scenario that demands a multifaceted approach to care. Comprehensive psychological interventions, including cognitive-behavioral therapy, mindfulness-based stress reduction, and supportive counseling, are essential to address the mental health needs of these patients. Additionally, nursing support plays a critical role in managing symptoms, providing education, and offering emotional reassurance to both patients and their families. By integrating psychological care with medical treatment, healthcare providers can improve patients' overall well-being, enhance their coping mechanisms, and ultimately alleviate the dual burden of physical and emotional suffering associated with lung cancer brain metastasis. This holistic approach is vital for optimizing patient outcomes and improving their quality of life in the face of this devastating disease.

The renowned American scholar Avedis Donabedian first proposed the Structure-process-outcome three-dimensional quality theory in 1966, suggesting that medical quality is a highly complex concept that cannot be evaluated from a single perspective. Instead, it should be comprehensively assessed from the three dimensions

of structure, process, and outcome, providing a systematic evaluation model for measuring medical quality and offering a scientific basis for the improvement of medical nursing services [11,12]. Implementing psychological support within the framework of the Structure-process-outcome three-dimensional quality theory is an innovative attempt. The structural dimension focuses on comprehensive assessments of patients' physiology, psychology, and living environment, as well as the integration of medical nursing resources. A multidisciplinary team, including oncologists, nursing staff, psychological counselors, and patients' family members, collaboratively develop intervention plans from different psychological support dimensions, creating high-quality resources and a conducive environment for implementing psychological support [13,14]. The process dimension is reflected in the implementation of psychological support services, such as the formulation, execution, and evaluation of nursing plans, with detailed records of patients' condition changes and psychological responses, and timely optimization and adjustment of plans to fully meet patients' health needs [15,16]. The outcome dimension focuses on the work quality and effectiveness of psychological support, with systematic monitoring and evaluation to continuously improve nursing intervention measures and enhance the overall quality of nursing services [17,18]. Study results show that after 20 weeks of nursing intervention, the GAD-7 and the emotional, physical, and economic dimensions of the SPBS scores in the observation group were all lower than those in the control group ($P < 0.05$). The author believes that the GAD-7 scale is a widely used assessment tool that can effectively capture individuals' psychological states in terms of anxiety, depression, and stress, helping to identify and assess related mental health issues and their severity, providing important reference for treatment and intervention [19,20]. The SPBS scale can measure in detail the self-perceived feelings and experiences of patients in emotional, physical, and economic dimensions, assisting medical staff in understanding the specific conditions of patients in these aspects, thereby providing more precise and personalized medical nursing plans [21,22]. By comparing the data between the observation and control groups, it can be found that after implementing psychological support guided by the Structure-process-outcome three-dimensional quality theory, the GAD-7 scores for anxiety and the emotional, physical, and economic dimensions of the SPBS scores in the observation group showed a more significant improvement, indicating that this nursing intervention model has a positive effect on improving the psychological state and quality of life of patients with lung cancer brain metastasis. Additionally, the study results show that after 20 weeks of nursing intervention, the scores in the physical, role, emotional, cognitive, and social functioning domains of the EORTC QLQ-C30 in the observation group were all higher than those in the control group ($P < 0.05$), while the scores in the fatigue, pain, and nausea/vomiting symptom domains were all lower than those in the control group ($P < 0.05$). The author believes that the EORTC QLQ-C30 scale is a widely used tool for assessing the quality of life in cancer patients, which can comprehensively evaluate the functional status of patients in physical, role, emotional, cognitive, and social aspects, as well as the severity of common symptoms such as fatigue, pain, and nausea/vomiting, reflecting the quality of life of patients [23–25]. psychological support guided by the structure-process-outcome three-dimensional quality theory not only effectively alleviates the negative emotions of patients with lung cancer brain

metastasis but also significantly reduces symptom distress and improves the overall quality of life. Furthermore, the study results also show that the nursing intervention satisfaction in the observation group was 100.00%, higher than the 81.48% in the control group ($P < 0.05$). The author believes that the improvement in satisfaction not only reflects patients' recognition of nursing services but also reflects the professionalism and service quality of the nursing team in providing psychological support. By implementing psychological support based on the Structure-process-outcome three-dimensional quality analysis, patients with lung cancer brain metastasis and anxiety can obtain better nursing service experiences, meets not only their physiological needs but also providing great psychological support, thereby significantly improving patient satisfaction. However, this study also has certain limitations, such as a relatively small sample size, short duration, and single center, which may affect the representativeness, universality, and long-term nature of the results. It is necessary to further expand the sample size, increase multi-center cooperation, and conduct long-term follow-ups to further verify the application effects of psychological support in patients with lung cancer brain metastasis.

This study uniquely applies the SPO framework to guide psychological support. Unlike previous studies that primarily focused on single-dimension interventions, our SPO framework integrates the structural, process, and outcome dimensions. This ensures that psychological support is tailored specifically to the needs of patients with lung cancer brain metastasis and anxiety. The framework provides a structured approach to address the complex needs of these patients, thereby improving their prognosis and satisfaction with care. Future research should further explore the long-term effects of this approach and its applicability to other patient populations.

5. Conclusions

In conclusion, psychological support based on the Structure-process-outcome (SPO) three-dimensional quality analysis model demonstrates significant clinical value in improving the psychological well-being, quality of life, and nursing satisfaction of patients with lung cancer brain metastasis (LCBM) and anxiety. By integrating structured psychological interventions, such as cognitive-behavioral therapy and mindfulness-based stress reduction, within a robust care framework, this approach addresses the multifaceted challenges faced by LCBM patients. Outcome evaluations reveal sustained reductions in anxiety ($p < 0.01$) and improvements in emotional functioning ($p < 0.05$), alongside enhanced nursing satisfaction. The SPO model provides a scalable, evidence-based framework for optimizing psycho-oncology care, with potential applications across diverse healthcare settings and patient populations, ultimately contributing to more holistic and effective cancer treatment.

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Ethical approval: The procedures for both T1 and T2 surveys adhered to the (i) Declaration of Helsinki, and (ii) ethical principles for medical, psychological, and sociological research involving human participants. The Nantong Cancer Hospital Research Ethics Committee approved the study protocol (EC-AF(SQ)-12/20230121).

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

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

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