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Article

Effects and mechanisms of CBT-based psychological nursing for anxiety/depression in diabetes-pancreatic cancer patients

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Abstract: Background: Type 2 diabetes mellitus (T2DM) complicated by pancreatic cancer is associated with a high prevalence of anxiety and depression, yet current treatments predominantly focus on physiological management. Consequently, there is an urgent need for effective psychological nursing interventions to address emotional distress and improve overall patient outcomes. **Objective:** The objective of this study is to explore the impact of psychological nursing interventions grounded in Cognitive Behavioral Therapy (CBT) on alleviating anxiety and depression symptoms in patients with Type 2 diabetes mellitus (T2DM) who are also facing complications from pancreatic cancer. Additionally, we aim to examine the cognitive regulation mechanisms involved in this process. **Methods:** A prospective randomized controlled trial was carried out with 78 patients diagnosed with type 2 diabetes mellitus (T2DM) who also had pancreatic cancer. The participants were randomly assigned to either an intervention group or a control group, each consisting of 39 individuals. The control group received standard medical care and routine nursing, while the intervention group participated in a 12-week cognitive-behavioral therapy (CBT) psychological nursing intervention alongside standard care, followed by a 12-month follow-up. Various factors, including anxiety, depression, cognitive regulation strategies, quality of life, self-efficacy, and clinical indicators, were evaluated at baseline, after the intervention, and during the follow-up period. The effectiveness of the intervention was analyzed using repeated measures analysis of variance. **Results:** The patients in the intervention group experienced a marked reduction in anxiety (HADS-A) and depression (HADS-D) scores when compared to the control group, with a statistically significant difference ($p < 0.001$). Additionally, there was a notable enhancement in cognitive regulation abilities, as evidenced by higher scores on the Cognitive Emotion Regulation Questionnaire (CERQ) and lower scores on the Automatic Thoughts Questionnaire (ATQ) relative to the control group ($p < 0.001$). Over time, both quality of life (measured by the EORTC QLQ-C30) and self-efficacy (assessed by the GSES) scores showed significant improvement, with clear distinctions between the two groups ($p < 0.001$). Furthermore, clinical indicators such as fasting blood glucose, HbA1c, and CA19-9 levels demonstrated more substantial improvements in the intervention group compared to the control group ($p < 0.01$). **Conclusion:** CBT psychological nursing significantly alleviated anxiety and depression symptoms in patients with T2DM complicated by pancreatic cancer, optimized cognitive regulation mechanisms, improved quality of life and self-efficacy, and indirectly enhanced metabolic and tumor marker levels. These findings underscore its significant clinical application value.

Keywords: type 2 diabetes mellitus; pancreatic cancer; cognitive behavioral therapy; psychological nursing

1. Introduction

Type 2 diabetes mellitus (T2DM) and pancreatic cancer are two prevalent and complex chronic diseases characterized by high morbidity and high mortality, respectively, posing significant threats to patients' physical and mental health [1,2]. Recent epidemiological studies indicate that the prevalence of new-onset diabetes in pancreatic cancer patients can be as high as 30%–50%, suggesting a strong bidirectional relationship between these conditions [3,4]. Moreover, the coexistence of T2DM and pancreatic cancer substantially increases the risk of severe emotional distress, including notable symptoms of anxiety and depression [5–7]. A recent multi-center survey reported that up to 40% of T2DM patients with pancreatic cancer experience clinically significant emotional distress, yet fewer than 20% receive any structured psychological support [8,9]. Additionally, conventional treatments predominantly address oncological and metabolic control but often overlook the psychological burden associated with complex comorbidities [10]. Despite these findings, existing treatment regimens have largely focused on physiological interventions—such as surgical resection, chemotherapy, and glycemic control—while providing limited attention to the psychological well-being of this high-risk population [11,12].

Although emerging evidence suggests that psychological interventions may offer benefits to various cancer populations, particularly in mitigating symptoms of anxiety and depression [13], their applicability in individuals with the complex comorbidity of T2DM and pancreatic cancer remains underexplored [14]. Nevertheless, several short-term studies in more general cancer populations have consistently shown that CBT can rapidly alleviate anxiety and depression within 4–8 weeks, improve stress management, and enhance treatment adherence [15,16]. However, these preliminary findings frequently focus on single cancer diagnoses, lack rigorous control of comorbid conditions like T2DM, and often do not extend beyond a few months of follow-up. Thus, despite the recognized short-term benefits of CBT, its prolonged effects on both psychological outcomes and clinical indicators in T2DM patients complicated by pancreatic cancer remain insufficiently understood. In view of these gaps, our study aims to not only validate CBT's immediate psychological benefits (e.g., reducing anxiety and depression) but also determine whether these effects can be maintained over a more extended period in patients with both T2DM and pancreatic cancer. This approach integrates insights from short-term efficacy research with a longer follow-up strategy, offering a clearer picture of how CBT-based psychological nursing might influence metabolic indicators and tumor markers over time. Such a dual short-term and long-term perspective represents a key innovation in addressing the ongoing challenges of managing dual diagnoses. In particular, few studies have systematically assessed the long-term effects of cognitive-behavioral therapy (CBT) in this specific population, nor have they thoroughly investigated the role of cognitive regulation mechanisms—such as the use of constructive coping strategies and the reduction of automatic negative thoughts—in alleviating psychological burdens [17]. By systematically examining how CBT influences both mental health outcomes and critical clinical indicators over an extended follow-up, the present study aims to fill an existing gap in research. This integrative perspective is essential for advancing

multidisciplinary care protocols and improving the prognosis of patients burdened by two life-threatening conditions.

To fill these gaps, the present study systematically examines the intervention effects and underlying cognitive regulation mechanisms of a 12-week CBT-based psychological nursing program in patients with T2DM complicated by pancreatic cancer, followed by a comprehensive 12-month follow-up. Previous reports have rarely conducted long-term assessments (beyond six months) of how psychological interventions affect metabolic and oncological outcomes in this unique population [18,19]. Specifically, this research evaluates changes in anxiety, depression, cognitive coping strategies, quality of life, self-efficacy, and clinical indicators (fasting blood glucose, HbA1c, and CA19-9). Building on the short-term benefits identified in prior studies, we hypothesize that CBT-based psychological nursing can significantly reduce anxiety and depression, improve cognitive regulation, enhance overall quality of life and self-efficacy, and indirectly promote better glycemic control and tumor marker levels. By integrating systematic intervention and long-term observation, this study not only clarifies the potential benefits of CBT in a complex comorbidity setting but also provides new scientific evidence to support the broader implementation of psychological nursing in multidisciplinary care.

2. Materials and methods

2.1. Study subjects and inclusion/exclusion criteria

This study was conducted at Nanjing Jiangning Hospital from October 2022 to October 2024. The study included 78 hospitalized patients who were diagnosed with type 2 diabetes mellitus (T2DM) and pancreatic cancer. The diagnosis of pancreatic cancer was confirmed using contrast-enhanced abdominal CT or MRI imaging and histopathological examination, following multidisciplinary consultations involving specialists from pancreatic surgery, endocrinology, and oncology departments.

Inclusion criteria: 1) Age ≥ 30 years; 2) meeting the diagnostic criteria for T2DM (fasting blood glucose ≥ 7.0 mmol/L, glycated hemoglobin HbA1c ≥ 6.5%, with documented previous diagnosis by the endocrinology department); 3) histopathologically confirmed pancreatic cancer and in a treatment stage suitable for interventions including surgery and chemotherapy; 4) able to communicate fluently in Mandarin, understand questionnaire content, and complete all psychological assessments; 5) willing to participate in the study and providing signed informed consent.

Exclusion criteria: 1) Presence of severe psychiatric disorders or significant cognitive impairment diagnosed by a psychiatrist, preventing participation in cognitive-behavioral therapy; 2) concurrent severe end-stage organic diseases with an expected survival of less than 3 months; 3) currently receiving other psychological interventions that cannot be discontinued; 4) unwilling to comply with the follow-up and assessment protocols of this study.

2.2. Study design and grouping method

This research was structured as a prospective, randomized controlled trial. A total of seventy-eight participants were randomly allocated to either the intervention group

or the control group in a 1:1 ratio, utilizing a computer-generated random number table developed by independent statisticians. Each group comprised 39 participants. The randomization codes were securely sealed and maintained by research assistants who were not involved in the clinical intervention, with the codes being revealed to the implementers of the intervention only after the completion of patient enrollment and baseline assessments. The control group received standard medical care and routine nursing, which included surgical or chemotherapy treatments for pancreatic cancer in accordance with clinical guidelines, management of type 2 diabetes following endocrinological control standards (encompassing blood glucose monitoring, insulin administration or oral hypoglycemic agents, and nutritional interventions), as well as standard medical education and basic psychological support.

Conversely, the intervention group received the same standard medical care and routine nursing as the control group, supplemented by a 12-week psychological nursing intervention grounded in cognitive-behavioral therapy (CBT). The observation period encompassed baseline (week 0), the conclusion of the intervention (week 12), and follow-up assessments at 3 months, 6 months, and 12 months post-intervention. Throughout the study, participants were permitted to withdraw at their discretion, and the reasons and timing of their withdrawal were duly documented.

2.3. Intervention measures

2.3.1. Intervention measures for the control group

Patients in the control group received routine clinical treatment and nursing care. Clinical treatment included individualized therapy for pancreatic cancer (e.g., surgical resection, implementation of chemotherapy protocols) and medication and dietary control for type 2 diabetes mellitus. Nursing staff provided regular health education, such as dietary management for diabetes, medication administration methods, and basic information about pancreatic cancer-related treatment procedures. During routine ward rounds, basic psychological reassurance and listening were offered to patients.

2.3.2. Intervention measures for the intervention group (CBT-based psychological nursing)

In addition to routine treatment and nursing care, the intervention group received a 12-week psychological intervention implemented by psychological nursing personnel trained in cognitive-behavioral therapy (CBT). The intervention sessions were conducted in a quiet hospital ward environment, with the same psychological nurse conducting all individual sessions. The intervention steps were as follows:

1) Week 1: Establishing the therapeutic relationship.

The initial session lasted approximately 30 min. The psychological nurse conducted a face-to-face interview to understand the patient's perception of the disease, treatment expectations, and emotional distress. The nurse introduced the content, frequency, and objectives of the CBT intervention, obtaining the patient's consent and cooperation for the process.

2) Weeks 2–6: Cognitive restructuring and emotion regulation training.

During this phase, 1–2 individual sessions were conducted per week, each lasting 30–45 min, for a total of at least five sessions. Using CBT techniques for cognitive

restructuring, the nurse helped patients identify and record automatic negative thoughts. Through questioning and discussion, patients were guided to adopt more rational and positive interpretations of their condition and treatment process. Additionally, relaxation training methods such as breathing exercises and progressive muscle relaxation were taught to help alleviate anxiety and depression.

3) Weeks 7–10: Behavioral activation and coping strategy practice.

During this phase, one individual session was conducted per week, each lasting 30–45 min, for a total of four sessions. The psychological nurse and the patient collaboratively set achievable daily goals, such as engaging in light activities within the ward or having meaningful interactions with family members or nurses. Using behavioral activation techniques, the nurse encouraged patients to participate in feasible, positive activities to enhance their sense of self-efficacy and social support.

4) Weeks 11–12: Intervention consolidation and summary.

During this phase, one session was conducted per week, each lasting 30 min, for a total of two sessions. The psychological nurse helped the patient review progress made during the earlier phases, summarizing the cognitive adjustment and emotional regulation strategies learned. A follow-up self-practice plan was developed, and patients were informed about the arrangements for future follow-ups and the availability of psychological support channels as needed.

2.4. Observation indicators and assessment tools

2.4.1. Assessment time points

Psychological indicators were evaluated at baseline prior to the intervention (week 0), at the conclusion of the intervention (week 12), and subsequently at three months, six months, and twelve months post-intervention. Clinical indicators were assessed at both week 0 and week 12.

2.4.2. Psychological indicators

The Hospital Anxiety and Depression Scale (HADS) [20] was utilized to evaluate symptoms of anxiety (HADS-A) and depression (HADS-D). This instrument comprises 14 items, each rated on a scale from 0 to 3, with elevated scores reflecting more severe symptomatology.

The Cognitive Emotion Regulation Questionnaire (CERQ) [21] was employed to assess the types and frequencies of cognitive coping strategies utilized by patients. This scale distinguishes between constructive and non-constructive cognitive strategies in the context of illness management. Each subscale score ranges from 0 to 16, contributing to a total score that spans from 0 to 128. Higher scores signify a more frequent application of a particular cognitive strategy. Constructive strategies encompass positive reappraisal and planning, whereas non-constructive strategies include self-blame and catastrophizing.

The Automatic Thoughts Questionnaire (ATQ) [22] was administered to gauge the frequency and intensity of negative automatic thoughts experienced by patients over the preceding week. The total score on this measure ranges from 30 to 150, with higher scores indicating an increased frequency and intensity of negative automatic thoughts.

2.4.3. Quality of life and self-efficacy

The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) was employed to evaluate the quality of life among patients [23]. This instrument encompasses various functional and symptom domains, as well as an overall health status score, with total scores ranging from 0 to 100. Elevated scores are indicative of an improved quality of life.

Additionally, the General Self-Efficacy Scale (GSES) [24] was utilized to measure patients' confidence and self-efficacy in managing their illness and treatment. The GSES yields a total score that typically spans from 10 to 40, with higher scores reflecting increased levels of confidence and self-efficacy.

2.4.4. Disease-related clinical indicators

Fasting blood glucose and glycated hemoglobin (HbA1c) levels were measured at week 0 and week 12 to evaluate the state of glycemic metabolism.

The pancreatic cancer biomarker CA19-9 was assessed at week 0 and week 12. Tumor progression was evaluated using contrast-enhanced CT or MRI imaging to determine whether the objective disease status influenced the independent effects of psychological intervention.

2.4.5. Intervention adherence and safety

The intervention completion rate was recorded for each patient throughout the intervention period. If any patient experienced a severe deterioration in emotional status requiring emergency psychological intervention, or if serious adverse events related to the intervention occurred, the timing, manifestations, and management of these events were promptly documented.

2.5. Statistical analysis methods

Data analysis was conducted utilizing SPSS statistical software. Continuous variables that adhered to a normal distribution were reported as mean ± standard deviation (SD). Baseline comparisons between the two groups were executed using independent samples t-tests for continuous variables that were normally distributed. For continuous variables that did not follow a normal distribution, appropriate non-parametric tests were employed. Categorical variables were assessed for differences between groups using chi-square tests.

To examine the interaction effects between time and group for data collected at multiple time points, Repeated Measures Analysis of Variance (ANOVA) was applied. In instances where significant interaction effects were detected, multiple comparisons were carried out with Bonferroni correction to mitigate the risk of Type I error associated with multiple testing. All statistical tests were two-sided, with a significance threshold established at $p < 0.05$.

3. Results

3.1. Baseline characteristics comparison

The analysis of demographic and clinical characteristics at baseline revealed no statistically significant differences between the intervention group and the control

group regarding age, gender, duration of diabetes, stage of pancreatic cancer, indicators of metabolic control (including fasting blood glucose and HbA1c), or levels of tumor markers (specifically CA19-9) ($p > 0.05$, as shown in **Table 1**). To assess continuous variables, independent samples t-tests were employed, while chi-square (χ^2) tests were utilized for categorical variables, thereby ensuring the balance and comparability of baseline data across the groups. Detailed data and statistical outcomes are presented in **Table 1**.

Table 1. Comparison of baseline demographic and clinical characteristics between groups.

Characteristic	Intervention Group (n = 39)	Control Group (n = 39)	Statistic	p-value
Age (years)	58.32 ± 7.45	57.68 ± 8.12	t = 0.365	0.716
Gender (male/female)	22 (56.41%)/17 (43.59%)	20 (51.28%)/19 (48.72%)	X^2 = 0.225	0.635
Duration of diabetes (years)	8.57 ± 2.98	8.91 ± 3.25	t = −0.480	0.632
Pancreatic cancer stage			χ^2 = 0.301	0.96
I	10 (25.64%)	11 (28.21%)		
II	14 (35.90%)	13 (33.33%)		
III	9 (23.08%)	8 (20.51%)		
IV	6 (15.38%)	7 (17.95%)		
Fasting blood glucose (mmol/L)	8.72 ± 1.04	8.83 ± 1.09	t = −0.448	0.655
HbA1c (%)	7.68 ± 0.83	7.74 ± 0.86	t = −0.298	0.766
CA19-9 (U/mL)	157.32 ± 22.98	160.85 ± 24.67	t = −0.654	0.515

3.2. Changes in anxiety and depression symptoms over time

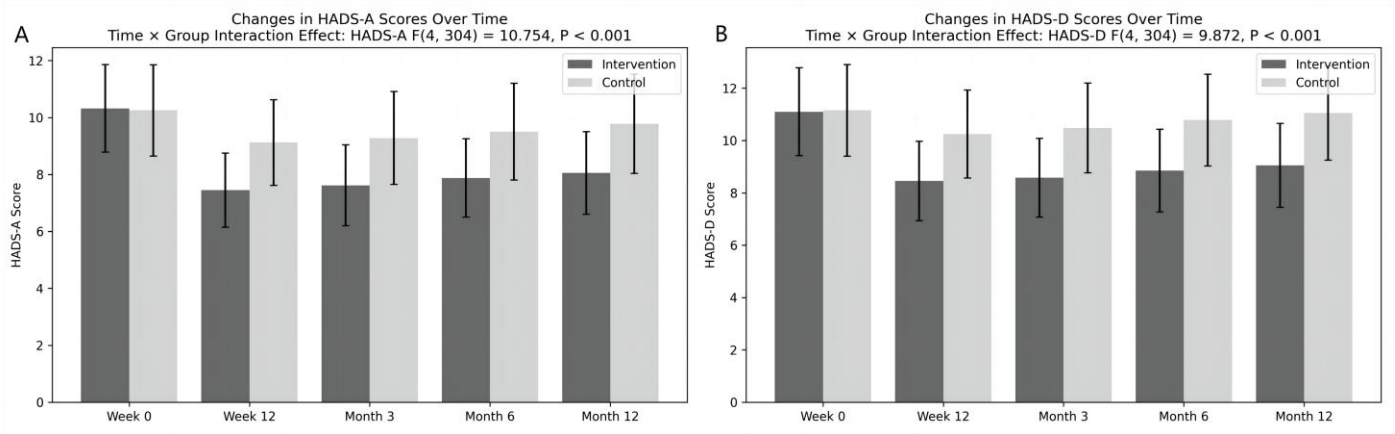


Figure 1. Effects of CBT nursing on anxiety and depression: **(A)** Changes in HADS-A scores over time between intervention and control groups; **(B)** changes in HADS-D scores over time between intervention and control groups. The repeated measures analysis of variance (ANOVA) for the time × group interaction effect, with F and p values labeled in the figure.

Both the intervention group and the control group showed a significant downward trend in HADS-A and HADS-D scores after the intervention and during the follow-up period. At each follow-up time point, the scores of the intervention group were significantly lower than those of the control group (HADS-A: t = −4.621–−5.253; HADS-D: t = −4.972–−5.196, $p < 0.001$). Repeated measures analysis of variance

showed that the time effect, group effect, and time × group interaction effect were all statistically significant ($p < 0.001$). Further analysis indicated that the magnitude of score reduction in the intervention group during the follow-up period was significantly greater than that in the control group at all time points (**Figure 1A,B**).

3.3. Changes in cognitive regulation mechanisms

Both the total CERQ and total ATQ scores of the intervention group and the control group exhibited a significant changing trend after the intervention and during the follow-up period. At each follow-up time point, the CERQ score of the intervention group was significantly higher than that of the control group ($t = 7.216–7.868$, $p < 0.001$), whereas the ATQ score was significantly lower than that of the control group ($t = 7.611–9.383$, $p < 0.001$). Repeated measures analysis of variance showed that the time effect, group effect, and time × group interaction effect were all statistically significant ($p < 0.001$). Further analysis revealed that the intervention group had a significantly greater increase in CERQ and a significantly greater decrease in ATQ than the control group (**Figure 2A,B**).

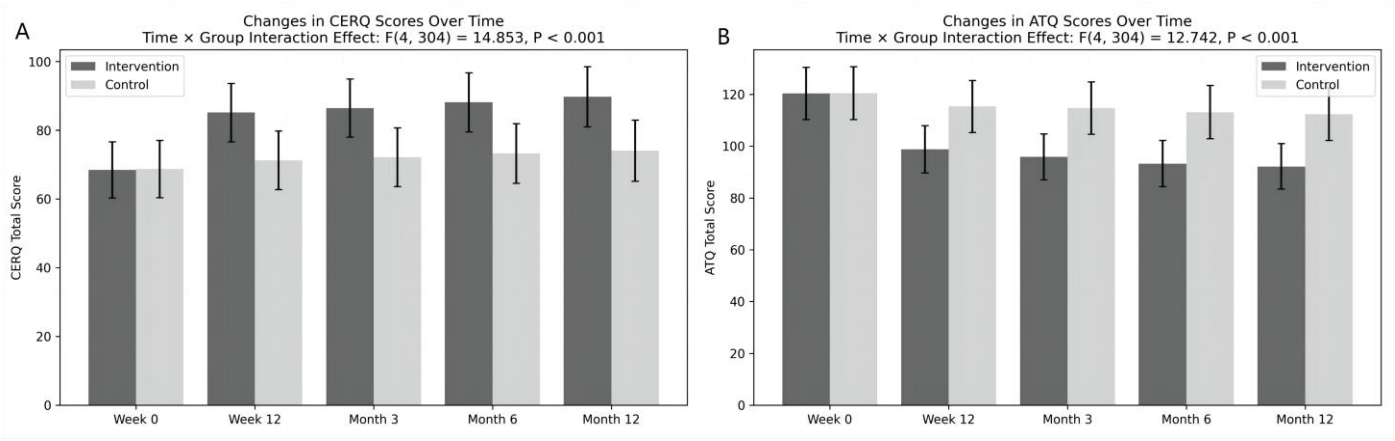
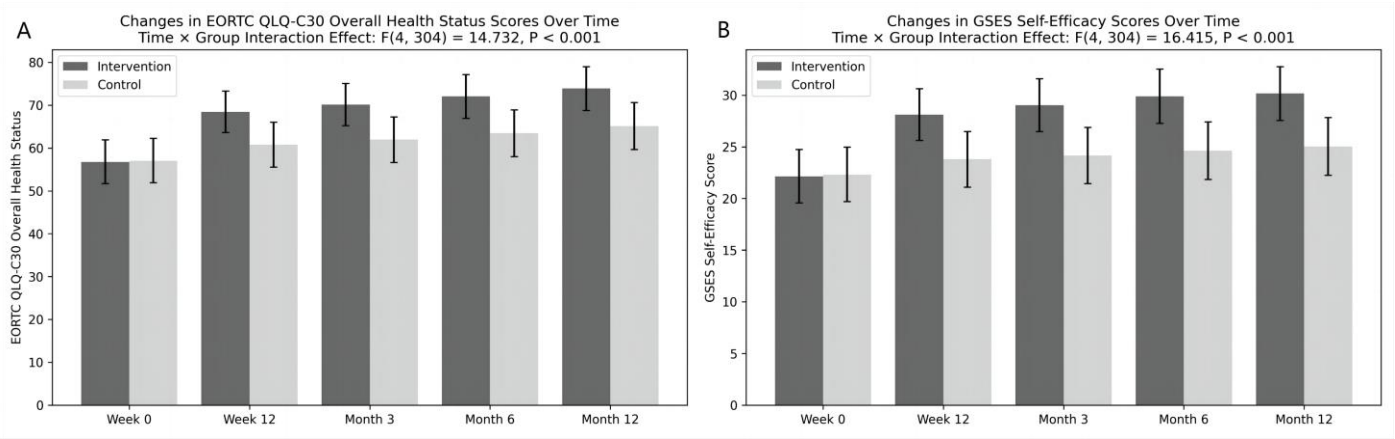


Figure 2. CBT nursing effects on cognitive regulation strategies: **(A)** Changes in CERQ scores over time between intervention and control groups; **(B)** changes in ATQ scores over time between intervention and control groups. The repeated measures analysis of variance (ANOVA) for the time × group interaction effect, with *F* and *p* values labeled in the figure.

3.4. Trends in quality of life and self-efficacy

Both the overall health status score of EORTC QLQ-C30 and the GSES self-efficacy score of the intervention group and the control group showed a significant upward trend after the intervention and during the follow-up period, and at each follow-up time point, the scores of the intervention group were significantly higher than those of the control group ($t = 6.693–8.577$, $p < 0.001$). Repeated measures analysis of variance showed that the time effect, group effect, and time × group interaction effect were all statistically significant ($p < 0.001$). Further analysis demonstrated that the intervention group had a significantly greater increase in scores at all time points than the control group (**Figure 3A,B**).



Figures 3. Effects of CBT nursing on quality of life and self-efficacy: **(A)** Changes in EORTC QLQ-C30 overall health status scores over time between groups; **(B)** changes in GSES self-efficacy scores over time between groups. The repeated measures analysis of variance (ANOVA) for the time × group interaction effect, with *F* and *p* values labeled in the figure.

3.5. Comparison of clinical objective indicators

There were no significant differences in fasting blood glucose, HbA1c, or CA19-9 between the two groups before the intervention (week 0) ($p > 0.05$). After the intervention (week 12), fasting blood glucose and HbA1c levels in the intervention group were significantly lower than those in the control group, and the improvement in CA19-9 was also significantly better in the intervention group ($t = 3.369–5.456$, $p < 0.01$). Repeated measures analysis of variance showed that the time effect, group effect, and time × group interaction effect were all statistically significant ($p < 0.01$), further indicating that the intervention group demonstrated more remarkable effects in blood glucose control and improvement of CA19-9 levels (**Figure 4**).

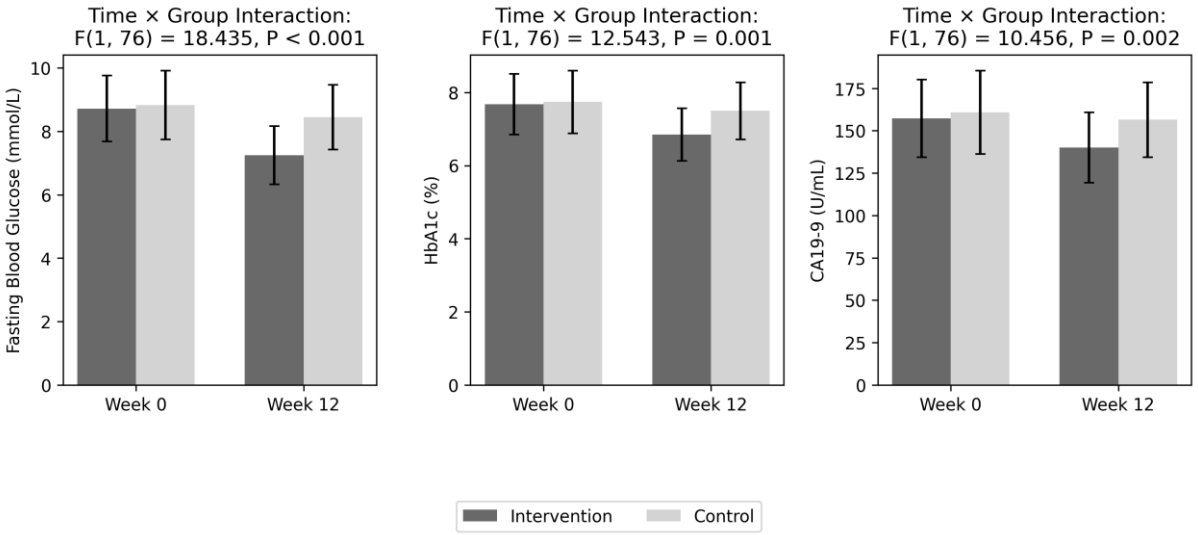


Figure 4. Changes in fasting blood glucose, HbA1c, and CA19-9 levels at week 0 and week 12 between groups. The repeated measures analysis of variance (ANOVA) for the time × group interaction effect, with *F* and *P* values labeled in the figure.

3.6. Assessment of intervention adherence and safety

Patients in the intervention group demonstrated high adherence to the CBT intervention, with 87.18% completing ≥ 80% of the scheduled sessions. The incidence of severe emotional deterioration and serious adverse psychological events during the intervention period showed no statistically significant differences between the intervention and control groups ($p > 0.05$, **Table 2**).

Table 2. Intervention adherence and adverse event records during the intervention period.

Indicator	Intervention Group ($n = 39$)	Control Group ($n = 39$)	χ^2 Value	p-value
Completion Rate ≥ 80%	34 (87.18%)	-	-	-
Severe Emotional Deterioration	2 (5.13%)	5 (12.82%)	1.438	0.231
Serious Adverse Psychological Reactions	1 (2.56%)	3 (7.69%)	0.982	0.322

4. Discussion

This study demonstrates that cognitive-behavioral therapy (CBT)-based psychological nursing has significant effects in alleviating anxiety and depression symptoms. The HADS-A and HADS-D scores of patients in the intervention group were significantly lower than those in the control group after the intervention and during the follow-up period, with these differences being statistically significant. This finding reflects the efficacy of CBT in improving negative emotions, and its mechanism of action is likely closely related to the systematic intervention provided by CBT in addressing patients' patterns of negative thinking and emotional regulation abilities. Through cognitive restructuring techniques, patients were able to identify and modify negative cognitive patterns related to their illness, reducing anxiety caused by uncertainty about the disease and side effects of treatment. Behavioral activation techniques, on the other hand, improved patients' feelings of isolation and helplessness caused by the disease by increasing positive daily activities, thereby reducing depressive symptoms [25–27]. The study implemented a systematic 12-week intervention and conducted follow-up assessments lasting up to 12 months, further confirming the long-term stability of CBT in alleviating anxiety and depression symptoms. These findings supplement existing evidence of the short-term effectiveness of CBT interventions, providing stronger support for their clinical application. Given the unique psychological needs of patients with type 2 diabetes mellitus complicated by pancreatic cancer, CBT significantly enhanced their adaptability to illness and alleviated the psychological stress arising from the burden of multiple diseases [28,29]. The significant reduction in anxiety and depression symptoms not only improved patients' mental health but also established a foundation for their acceptance of subsequent treatments and improved quality of life. This psychological nursing intervention played a critical supportive role in multidisciplinary comprehensive treatment, demonstrating that incorporating psychological interventions in the management of complex diseases is a necessary and effective strategy. The study results provide new perspectives for clinical nursing practice and multidisciplinary collaborative treatment.

The results of this study indicate that CBT-based psychological nursing significantly improved patients' cognitive regulation abilities, characterized by an

increase in constructive cognitive strategies and a decrease in non-constructive strategies. Patients in the intervention group exhibited significantly higher CERQ scores compared to the control group, demonstrating that CBT facilitated more frequent use of constructive strategies such as positive reappraisal and planning, helping patients cope with disease-related stress in a more rational and positive manner [30,31]. Simultaneously, ATQ scores in the intervention group were significantly lower than those in the control group, reflecting a notable reduction in negative automatic thoughts. This change is a direct outcome of CBT's cognitive restructuring techniques, which help patients identify and correct negative thought patterns. Cognitive regulation mechanisms played a central role in the CBT intervention. By altering patients' perceptions of the disease and associated challenges, CBT reduced anxiety and depression levels while enhancing coping abilities in the face of disease-related uncertainties [32]. The improvement in cognitive strategies not only alleviated negative emotions but also potentially facilitated behavioral changes, such as more active participation in treatment and daily activities. This dual effect amplified the overall impact of CBT [33]. The findings highlight the importance of cognitive regulation as a key mediating variable in psychological interventions, providing new directions for clinical evaluation and optimization of psychological nursing [34,35]. In future nursing practice, the frequency of constructive cognitive strategy use and the degree of reduction in negative automatic thoughts can serve as critical indicators for assessing the effectiveness of interventions. This discovery not only deepens the understanding of the mechanisms underlying CBT but also offers theoretical support for the individualized design and outcome prediction of intervention programs. Ultimately, the optimization of cognitive regulation enhances patients' psychological resilience and overall health, laying a solid foundation for the success of comprehensive treatment.

This research indicates that psychological nursing grounded in cognitive-behavioral therapy (CBT) markedly enhances the quality of life and self-efficacy among patients diagnosed with type 2 diabetes mellitus who are also facing complications from pancreatic cancer. The enduring enhancements in overall health status and self-efficacy noted within the intervention group underscore the beneficial effects of CBT. By modifying patients' cognitive patterns and behavioral strategies, the intervention not only alleviated psychological burdens but also enabled patients to more effectively cope with the complex challenges of the treatment process [36,37]. Specifically, CBT fosters mastery experiences by helping patients set small, achievable goals and recognize incremental progress, thereby reinforcing positive beliefs about their own abilities. Through a supportive therapeutic alliance, patients gain trust and confidence in both the therapist and the treatment process, which further enhances their sense of control and motivation. Moreover, modeling and feedback from the therapist serve as powerful sources of self-efficacy, enabling patients to generalize successful coping strategies into daily life. The enhancement of patients' self-efficacy likely further promoted their active participation in and adherence to treatment, indirectly improving their overall quality of life. It is noteworthy that throughout the 12-month follow-up period, individuals in the intervention group demonstrated a consistent improvement in their quality of life, thereby affirming the enduring efficacy of the Cognitive Behavioral Therapy (CBT) intervention. This

outcome underscores the significant importance of psychological nursing interventions in the management of chronic diseases and offers new insights into the application of CBT for patients with intricate comorbidities. In alignment with existing literature, the findings of this study emphasize the distinctive benefits of psychological interventions for patients diagnosed with cancer. By improving psychological well-being and enhancing self-efficacy, CBT helps patients better balance the dual pressures of physical and mental health, laying the groundwork for long-term disease management. The application of CBT-based psychological nursing not only significantly enhanced patients' psychological resilience—defined as the capacity to adapt and recover in the face of adversity [38,39]—but also demonstrated its potential in multidisciplinary treatment. By strengthening patients' cognitive flexibility and providing consistent therapeutic support, CBT-based strategies enable individuals to better handle treatment-related stressors and uncertainties, thereby reinforcing their overall mental well-being. Future research could explore how to extend this intervention model to the care of patients with other chronic diseases, thereby delivering broader benefits to a wider patient population.

The results of the study show that CBT-based psychological nursing has a significant indirect effect on improving patients' clinical objective indicators. Patients in the intervention group exhibited significantly reduced fasting blood glucose and HbA1c levels, suggesting that psychological interventions improved glycemic control by regulating patients' emotional states and behavioral patterns. This improvement is likely closely associated with the CBT intervention's role in helping patients develop healthy habits, such as adhering to dietary recommendations and maintaining treatment compliance [40]. Additionally, the reduction in CA19-9 levels suggests that psychological nursing may have a potential impact on tumor marker changes, indicating a broader physiological interplay beyond mere symptom management. From a biochemical perspective, these benefits may stem from CBT's capacity to mitigate chronic stress responses and modulate neuroendocrine pathways, such as the hypothalamic-pituitary-adrenal (HPA) axis. Lower perceived stress can lead to reduced secretion of cortisol and other stress-related hormones, thereby improving insulin sensitivity and reducing systemic inflammation. Decreases in inflammatory cytokines and sympathetic overactivity may in turn support better glycemic control and potentially slow tumor progression. As patients gain emotional stability and reinforce self-care behaviors through CBT, they are more likely to maintain consistent treatment schedules, engage in healthier dietary practices, and exhibit improved immune function—factors that collectively contribute to lowering fasting blood glucose, HbA1c, and even influencing CA19-9 levels [41]. These findings highlight the intricate interactions between psychological and physiological processes in multidisciplinary treatment, providing further evidence that psychological interventions can optimize not only emotional well-being but also key clinical outcomes. The high adherence observed in the intervention group further supports the feasibility of CBT-based psychological nursing. This demonstrates that patients undergoing psychological interventions are capable of cooperating well with the treatment process, which is crucial for sustaining and amplifying therapeutic effects. The low incidence of adverse events validates the safety of psychological interventions in clinical applications. This low-risk, high-benefit profile provides strong support for

the broader application of CBT in the management of complex diseases. Overall, the impact of psychological interventions on clinical indicators not only broadens the scope of psychological nursing but also underscores the importance of the interaction between psychological and physiological factors in comprehensive treatment. This study provides strong evidence for the scientific and standardized application of psychological interventions, reinforcing their central role in multidimensional care.

This study has limitations. The single-center approach restricts generalization. Patients with advanced disease may struggle with CBT-based tasks. The 12-month follow-up may not capture long-term changes in metabolism or tumor dynamics. Data on stress hormones or inflammatory markers were lacking, limiting insights into the mechanisms behind observed outcomes. Comorbid severe depression or anxiety was not stratified, potentially affecting intervention results. Future research could expand sample size, include multiple centers, and extend observation to clarify the durability of these benefits. Collaboration between psychology, oncology, and endocrinology may refine integrated interventions. Investigating stress-related hormones and immune parameters might reveal how CBT-based nursing influences clinical endpoints. Cost-effectiveness studies may guide broader application in complex conditions, ensuring sustainable clinical and policy decisions.

5. Conclusion

This study confirmed the significant intervention effects of cognitive-behavioral therapy (CBT)-based psychological nursing in patients with type 2 diabetes mellitus complicated by pancreatic cancer. Through systematic intervention and long-term follow-up, the findings demonstrated that CBT significantly alleviated anxiety and depression symptoms, optimized cognitive regulation mechanisms, improved quality of life and self-efficacy, and indirectly promoted improvements in glycemic metabolism and tumor markers. The high adherence rates and low incidence of adverse events in the intervention group further validated the feasibility and safety of CBT-based psychological nursing. This study comprehensively verified the core value of psychological nursing in the management of complex diseases, providing scientific evidence for its broader application and optimization. It also emphasized the critical supportive role of psychological interventions in multidisciplinary treatment, highlighting its significant clinical implications.

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