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Continuous nursing for postoperative quality of life in gastric cancer: A randomized trial

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Abstract: Background: Gastric cancer (GC) is the fifth most common malignant tumor in the world in terms of incidence rate and the second most common malignant tumor in terms of mortality. The postoperative condition of patients with GC metastasis is still poor. How to effectively improve the quality of life (QoL) of postoperative patients has gradually become the key target to current treatment. This study aimed to explore the impact of continuous nursing care on the QoL of GC lung metastasis patients, to better implement treatment for GC patients and improve their QoL. **Methods:** 102 patients with GC lung metastasis in the First Hospital of China Medical University were randomly divided into control group and observation group. The control group was given routine nursing, and the observation group was given continuous nursing care. The anxiety, depression and QoL scores of patients: physical function, role function, emotional function, cognitive function, and social function, were observed at the time of discharge, 3 months, 6 months and 1 year after discharge. **Results:** The improvement of anxiety and depression in the observation group was significantly better than that in the control group (both $P < 0.005$). The 5 variables of QoL in the observation group and control group after discharge were higher than those at discharge (all $P < 0.005$), and the scores of 5 variables in the observation group were significantly better than those in the control group (all $P < 0.005$). **Conclusion:** Through the implementation of continuous nursing care for patients with GC lung metastasis, it can effectively reduce and eliminate the negative psychological state of patients, significantly improve the QoL of patients, improve the rehabilitation effect of patients, and has high application value.

Keywords: continuous nursing care; gastric cancer lung metastasis; quality of life; anxiety; depression

1. Introduction

Gastric cancer (GC) is a formidable global health challenge, originating from the gastric mucosal epithelium and consistently ranking among the most prevalent and lethal malignancies worldwide. Current global cancer statistics position it as the fifth most common cancer in terms of incidence and the second leading cause of cancer-related mortality, accounting for a significant number of annual deaths [1]. The epidemiological distribution of GC is notably heterogeneous, with the highest burden observed in Eastern Asia, particularly in China, Japan, and South Korea [2]. Within China, the disease demonstrates a distinct demographic pattern, predominantly affecting individuals over the age of 50 and exhibiting a consistent male predominance [3]. Alarming, evolving lifestyle factors, including shifts towards Westernized dietary patterns and escalating psychosocial stress, are implicated in the rising incidence among younger cohorts. Compounding this issue are systemic challenges

such as the logistical difficulties of implementing large-scale population screening in a vast country and relatively low public awareness of early symptoms. Consequently, a disproportionate number of patients are diagnosed at advanced, inoperable stages, which severely constrains treatment options and culminates in a bleak prognosis [3].

The clinical management of GC is further complicated by its propensity for metastasis. The most frequent sites of dissemination include regional lymph nodes and distant organs, with the lungs being a common site for hematogenous spread [4]. The diagnosis of lung metastasis signifies stage IV disease, which is associated with limited survival and a profound symptom burden that drastically impairs quality of life [5]. Contemporary oncological research is increasingly focusing on understanding the biology of metastasis and evaluating novel therapeutic strategies. For example, recent investigations have explored the differential efficacy of immunotherapy across various metastatic sites in GC [6]. While surgical intervention remains the cornerstone of curative intent for localized disease, the high rates of postoperative recurrence and metastasis underscore the inadequacy of a purely tumor-directed approach. In the context of advanced disease, where cure is often unattainable, the primary treatment goals logically expand to encompass the palliation of symptoms, the mitigation of psychological suffering, and the optimization of the patient's remaining quality of life.

This evolution in therapeutic priorities mirrors the broader paradigm shift in medicine from a traditional biomedical model to a biopsychosocial model. This holistic framework posits that health outcomes are determined by a complex interplay of biological, psychological, and social factors [7–9]. It therefore mandates that comprehensive cancer care must extend beyond targeting the malignancy itself to actively address the patient's emotional well-being, functional capacity, and social integration. It is within this paradigm that the concept of continuous nursing care gains paramount importance. Initially formalized by the University of Pennsylvania in 1981 as an essential component of holistic care, continuous nursing is defined as a coordinated, patient-centered approach designed to ensure the seamless transition of care from the hospital to the community or home setting [10]. Its core objective is to bridge the gap that often exists following hospital discharge, thereby ensuring patient safety, promoting adherence to treatment plans, preventing complications, and ultimately, improving health-related quality of life [11,12]. While the model has been successfully applied in the management of other chronic conditions, its structured application and rigorous evaluation in the specific and complex context of patients with GC lung metastasis remain limited.

Therefore, the present study was conceived to address this evidence gap. We conducted a randomized controlled trial to rigorously evaluate the efficacy of a structured, multi-component continuous nursing care model versus routine care alone. The primary objective was to determine the intervention's impact on the psychological distress (anxiety and depression) and health-related quality of life of patients with GC lung metastasis over a 12-month period post-discharge. We hypothesized that patients receiving the continuous nursing intervention would demonstrate statistically significant and clinically meaningful improvements in these critical patient-reported outcomes compared to those receiving standard care.

2. Methods

2.1. Study design and participants

This investigation was a prospective, randomized, controlled, single-center trial conducted at the First Hospital of China Medical University. The study protocol received full approval from the institutional ethics committee (Approval No. 101022119), and all procedures were meticulously carried out in strict accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from every participant prior to their enrollment in the study.

Patient recruitment was conducted over a three-year period from June 2022 to June 2025. A total of 102 patients who met the predefined eligibility criteria were enrolled. The inclusion criteria were carefully formulated to select a homogeneous yet representative sample: (1) a histopathological confirmed diagnosis of gastric adenocarcinoma with concurrent radiological evidence (via CT or PET-CT) of lung metastasis; (2) age of 18 years or older; (3) possession of adequate self-awareness and cognitive capacity, as judged by the treating physician, to comprehend the study requirements and cooperate fully with the data collection procedures; (4) a state of clinical improvement and stabilization following their primary surgical and/or systemic oncological treatment at our institution; and (5) willingness and ability to provide written informed consent.

Conversely, the exclusion criteria were designed to minimize confounding factors: (1) the presence of severe comorbidities in other organ systems (e.g., New York Heart Association Class III/IV heart failure, severe chronic obstructive pulmonary disease, or end-stage renal disease) that could independently and substantially impair quality of life and confound the interpretation of the results; (2) a documented history of major cognitive impairment or psychiatric disorders that would preclude reliable questionnaire completion; (3) an expressed unwillingness to participate in the home visits or telephone follow-ups that constituted the core of the intervention; and (4) any other circumstance that, in the judgment of the principal investigator, would prevent the patient's meaningful participation in the full study protocol.

2.2. Randomization and blinding

Randomization procedure was employed to ensure the unbiased allocation of participants. Eligible subjects were randomly assigned in a 1:1 ratio to either the control group (routine care) or the observation group (continuous nursing care). The allocation sequence was computer-generated by an independent biostatistician who had no involvement whatsoever in patient recruitment, the delivery of interventions, or the assessment of outcomes. To safeguard the allocation sequence from tampering and selection bias, robust concealment was maintained using sequentially numbered, opaque, sealed envelopes (SNOSE). These envelopes were prepared by the independent statistician and stored securely. After a participant completed the baseline assessment and provided informed consent, a research nurse, who was not involved in the enrollment process, opened the next sequentially numbered envelope to reveal the group assignment.

2.3. Interventions

2.3.1. Control group protocol: Routine care

Patients allocated to the control group received the standard post-discharge nursing care that is routinely provided to oncology patients at our hospital. This protocol consisted of two main components. First, at the time of discharge, patients received routine discharge planning, which included verbal instructions and standardized printed leaflets covering general topics such as medication schedules, dietary recommendations, and activity guidelines. Second, they received regular telephone follow-ups. These calls were conducted on a monthly basis by a ward nurse who was not part of the research team. The content of these calls was not standardized and primarily focused on brief inquiries about the patient's general health status, medication adherence, and the scheduling of upcoming outpatient appointments. All contacts were documented concisely in the patient's general hospital discharge follow-up logbook.

2.3.2. Observation group protocol: Continuous nursing care

Patients in the observation group received a meticulously structured, multi-component continuous nursing intervention, which was delivered proactively for a full year following discharge. The intervention was orchestrated and delivered by a dedicated multidisciplinary team (MDT) comprising one senior oncologist, one head nurse, and two specially trained nurse supervisors. The protocol encompassed four core, integrated components:

Structured Telephone Follow-up System:

This was a proactive, scheduled follow-up system. Frequency was bi-weekly for the first three months post-discharge (a period of high vulnerability), transitioning to monthly calls for the remaining nine months. The executors were the two assigned nurse supervisors from the MDT. Each call followed a structured checklist covering several key domains: (a) Symptom Management: Systematic assessment of pain, nausea, fatigue, dyspnea, and other potential symptoms, with guided management strategies; (b) Medication Management: A detailed review of adherence, identification of potential side effects, and provision of management advice; (c) Nutritional Guidance: Personalized dietary counseling tailored to the patient's specific tolerances and nutritional needs; (d) Exercise and Activity Recommendations: Advice on tailored physical activity to maintain functional status; and (e) Psychological Support: Active listening, counseling, provision of reassurance, and assessment of emotional well-being. All interactions were documented in detail within individualized patient archives.

Scheduled Home Visit Program:

This component provided face-to-face, hands-on care in the patient's home environment. Visits were scheduled at 1 month, 3 months, 6 months, and 12 months post-discharge. The executing team typically consisted of one MDT nurse supervisor, sometimes accompanied by a community health worker for specific cases. The content of each visit was comprehensive and included: (a) a focused physical assessment; (b) direct observation and evaluation of the home environment for safety and accessibility; (c) hands-on demonstration and reinforcement of caregiving techniques for family

members; and (d) intensive reinforcement of previous education regarding disease management and lifestyle modifications.

Specialist Clinic Services:

To ensure seamless medical follow-up, a dedicated specialist outpatient clinic was established. This clinic was staffed by one or two chief physicians from the oncology department and held weekly. A critical feature was the pre-scheduling of the first several follow-up appointments before the patient was discharged from the hospital. A designated nurse supervisor was responsible for the management of this outpatient schedule, proactively sending reminders to patients via telephone or social media applications to ensure high attendance rates.

Online Health Education and Interactive Q&A Platform:

To leverage digital technology for continuous support, a closed social media group (e.g., on WeChat) was created exclusively for the observation group. The MDT posted curated health education materials weekly, covering topics like nutritional tips, managing treatment side effects, and gentle exercise routines. Additionally, scheduled weekly one-hour Q&A sessions were hosted, during which patients could ask questions and receive prompt, authoritative responses from members of the healthcare team.

2.3.3. Intervention adherence and fidelity monitoring

To ensure the consistent and faithful implementation of both protocols, adherence was closely monitored. For the observation group, a dedicated study coordinator maintained master schedules for all intervention components. The completion rate for telephone follow-ups was 92%, with a protocol of up to three attempts made for missed calls. The home visit completion rate was 89%, with a rescheduling option offered for missed appointments. Clinic attendance and engagement metrics on the online platform were systematically tracked. For the control group, adherence to the monthly telephone follow-ups was documented in the hospital's central records, which showed a 95% completion rate, with regular audits conducted by the head nurse to ensure consistency.

2.4. Evaluation

A questionnaire survey was conducted to assess the anxiety, depression, and QoL in two groups. The QoL scale primarily included five dimensions: physical function, role function, emotional function, cognitive function, and social function. The questionnaire was observed at four time points: at discharge, 3 months, 6 months and 1 year after discharge, and was conducted and recorded by a nurse during telephone follow-up. Supplementary file 1 displayed the variables in the questionnaire.

2.5. Statistical analysis

Statistical analysis was performed using SPSS 22.0. Measurement data were expressed as mean $\pm$ standard deviation ($\bar{x} \pm s$), with intergroup comparisons conducted using independent samples *t*-tests and intragroup comparisons using paired *t*-tests. Count data were expressed as n (%), with intergroup comparisons performed using chi-square tests. Repeated measures ANOVA was used to examine the changes

in scores across the various dimensions of quality of life after discharge. A significance level of $P < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of baseline characteristics between the two groups

The results showed no statistically significant differences in age, gender, or BMI between the two groups ($P > 0.05$), indicating that the groups were comparable (Table 1).

Table 1. Comparison of baseline characteristics between the two groups.

Groups	Patients	Age	Gender		BMI (kg/m ²)
			Male	Female	
Control Group	51	52.63 ± 5.14	31	20	23.43 ± 3.72
Observation Group	51	53.22 ± 6.71	25	26	22.58 ± 2.61
t/X^2		0.498	1.425		1.336
P		0.619	0.233		0.185

3.2. Comparison of anxiety and depression scores between the two groups

At discharge, there was no significant difference in anxiety and depression scores between the two groups. However, at the 1-year follow-up, the observation group exhibited significantly lower anxiety scores than the control group ($P < 0.001$) and significantly lower depression scores ($P < 0.001$). These results indicated that continuous nursing care is more effective than conventional nursing in improving patients' anxiety and depression (Figure 1, Supplementary file 2).

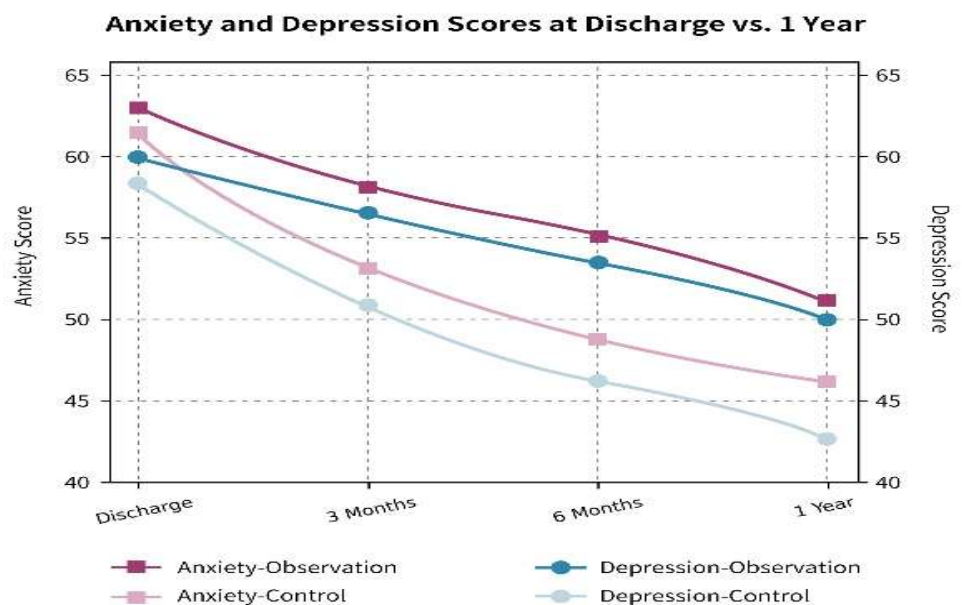


Figure 1. Line graphs of anxiety and depression scores at discharge, 3 months, 6 months and 1 year after discharge between the two groups.

3.3. Changes in physical function scores between the two groups

Analysis of variance (ANOVA) revealed a statistically significant main effect of time ($F_{\text{Time Effect}} = 11.214$, $P_{\text{Time Effect}} < 0.001$), a significant main effect of group ($F_{\text{Between-Group Effect}} = 25.032$, $P_{\text{Between-Group Effect}} < 0.001$), and a significant interaction between group and time ($F_{\text{Time} \times \text{Group Interaction}} = 3.590$, $P_{\text{Time} \times \text{Group Interaction}} = 0.002$). This demonstrated no significant difference between the two groups at discharge ($P > 0.05$). However, significant differences were observed at all follow-up time points compared to baseline ($P < 0.05$). Furthermore, the observation group exhibited significantly higher scores than the control group at all three follow-up time points ($P < 0.05$) (Figure 2, Supplementary file 3).

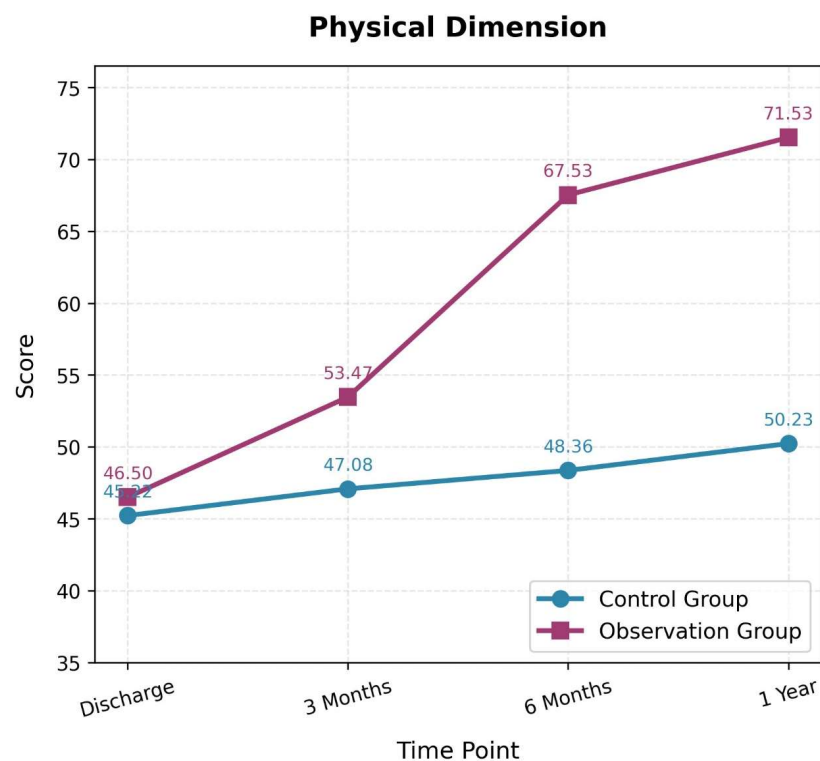


Figure 2. Line graphs of physical function scores at discharge, 3 months, 6 months and 1 year after discharge between the two groups.

3.4. Changes in role function scores between the two groups

ANOVA showed that the main effect of time was statistically significant ($F_{\text{time}} = 10.636$, $P_{\text{time}} < 0.001$), the main effect of group was statistically significant ($F_{\text{group}} = 21.528$, $P_{\text{group}} < 0.001$), and there was an interaction effect between group and time ($F_{\text{Time} \times \text{Group Interaction}} = 6.253$, $P_{\text{Time} \times \text{Group Interaction}} < 0.002$) which revealed that there was no statistically significant difference between the two groups at discharge ($P > 0.05$). However, all post-discharge time points showed statistically significant differences compared to the discharge time point ($P < 0.05$). At all three post-discharge time points, the observation group's scores were higher than those of the control group ($P < 0.05$) (Figure 3, Supplementary file 3).

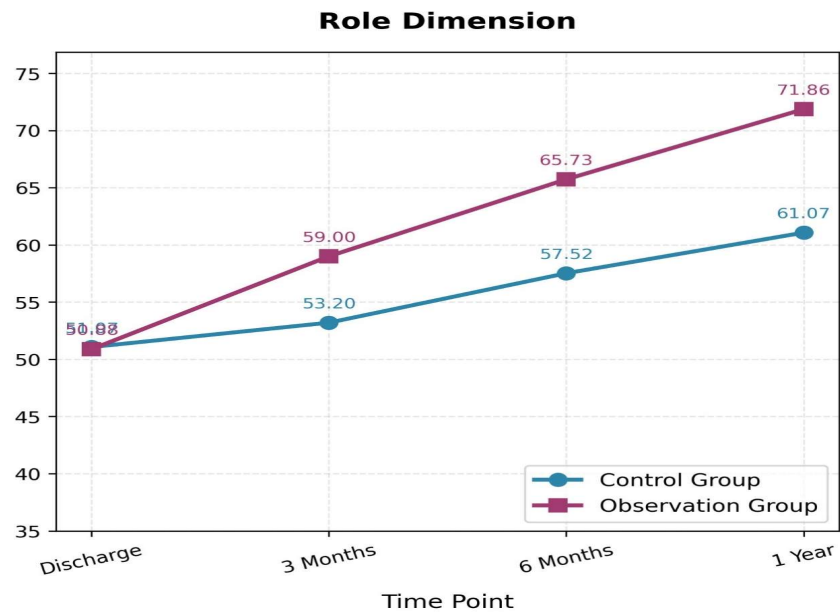


Figure 3. Line graphs of role function scores at discharge, 3 months, 6 months and 1 year after discharge between the two groups.

3.5. Changes in emotional function scores between the two groups

ANOVA revealed that the main effect of time was statistically significant ($F_{\text{Time Effect}} = 23.583$, $P_{\text{Time Effect}} < 0.001$), the main effect of group was statistically significant ($F_{\text{Between-Group Effect}} = 18.500$, $P_{\text{Between-Group Effect}} < 0.001$), and there was a significant interaction between group and time ($F_{\text{Time} \times \text{Group Interaction}} = 5.277$, $P_{\text{Time} \times \text{Group Interaction}} < 0.001$) which showed no statistically significant difference between the two groups at discharge ($P > 0.05$). However, all post-discharge time points exhibited statistically significant differences compared to the discharge time point (all $P < 0.05$). At the three post-discharge time points, the observation group's scores were significantly higher than those of the control group (all $P < 0.05$) (Figure 4, Supplementary file 3).

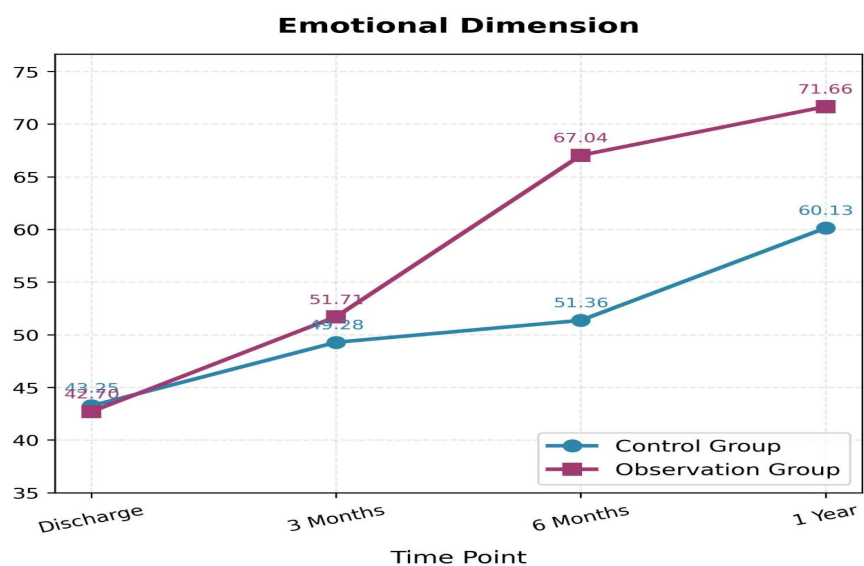


Figure 4. Line graphs of emotional function scores at discharge, 3 months, 6 months and 1 year after discharge between the two groups.

3.6. Changes in cognitive function scores between the two groups

ANOVA indicated a statistically significant main effect of time ($F_{\text{Time Effect}} = 8.623$, $P_{\text{Time Effect}} < 0.001$), a significant main effect of group ($F_{\text{Between-Group Effect}} = 12.713$, $P_{\text{Between-Group Effect}} < 0.001$), and a significant group $\times$ time interaction ($F_{\text{Time} \times \text{Group Interaction}} = 11.206$, $P_{\text{Time} \times \text{Group Interaction}} < 0.001$) which demonstrated no significant between-group difference at discharge ($P > 0.05$). However, all post-discharge time points showed statistically significant improvements compared to baseline ($P < 0.05$). At each follow-up assessment, the observation group scored significantly higher than the control group ($P < 0.05$) (Figure 5, Supplementary file 3).

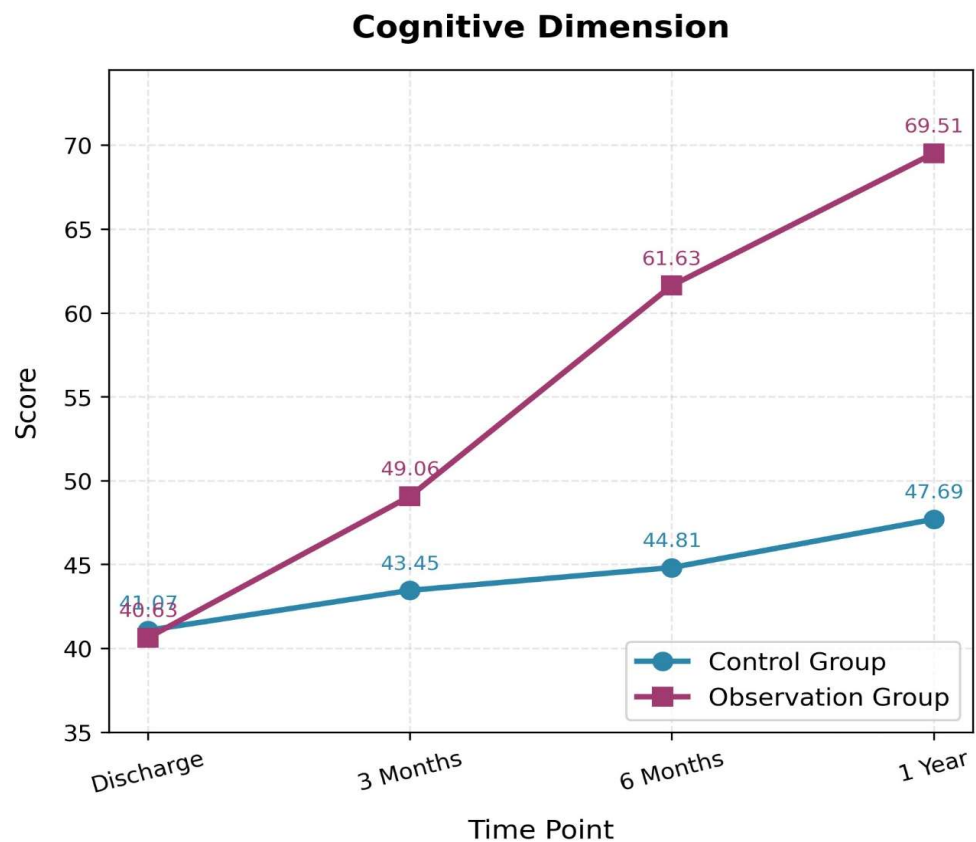


Figure 5. Line graphs of cognitive function scores at discharge, 3 months, 6 months and 1 year after discharge between the two groups.

3.7. Changes in social function scores between the two groups

ANOVA revealed statistically significant effects for time ($F_{\text{Time Effect}} = 9.817$, $P_{\text{Time Effect}} < 0.001$), group ($F_{\text{Between-Group Effect}} = 21.033$, $P_{\text{Between-Group Effect}} < 0.001$), and their interaction ($F_{\text{Time} \times \text{Group Interaction}} = 9.233$, $P_{\text{Time} \times \text{Group Interaction}} < 0.001$) which showed no significant between-group difference at discharge ($P > 0.05$). However, significant improvements were observed at all post-discharge assessments compared to baseline ($P < 0.05$). The intervention group demonstrated significantly higher scores than the control group at all three follow-up time points ($P < 0.05$) (Figure 6, Supplementary file 3).

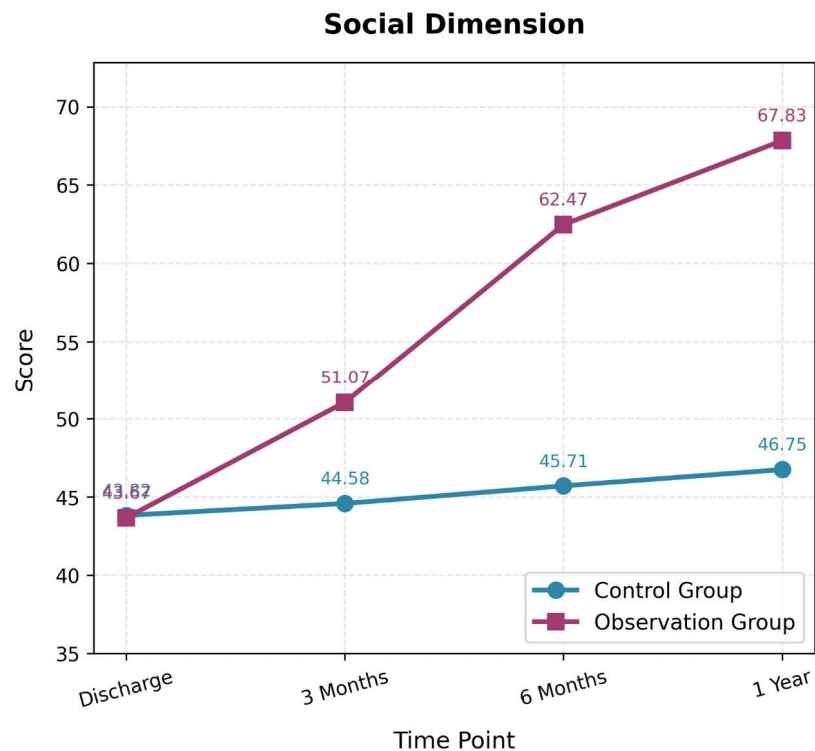


Figure 6. Line graphs of social function scores at discharge, 3 months, 6 months and 1 year after discharge between the two groups.

4. Discussion

GC patients often present with nonspecific early symptoms, leading to diagnosis at advanced stages in most clinical cases. Advanced-stage patients are particularly susceptible to lymph node and pulmonary metastases, resulting in an unfavorable prognosis [13]. Previous research has primarily focused on the impact of clinicopathological characteristics on the prognosis of metastatic GC and risk assessment based on these factors [14,15], while neglecting the influence of psychological status and QoL on treatment outcomes. As an open and extended model of nursing care [16], continuous nursing primarily delivers interventions through telephone follow-ups, specialist clinic services, and home visits [17]. This approach establishes an effective health communication channel between healthcare providers, patients, and their families, thereby promoting better health outcomes. In recent years, continuous nursing care has been widely adopted in various countries for conditions such as preterm infants [18], cardiovascular diseases [19], and stroke [20]. By comparing the changes of psychological and QoL of patients with GC lung metastasis between continuous nursing and routine care, this study found continuous nursing can significantly improve the postoperative psychological state and enhances QoL of patients with GC lung metastasis.

Given the WHO-classified impact of these psychopathological factors on cancer prognosis [21], standardized psychosocial support must be integrated into treatment algorithms to enhance coping mechanisms and therapeutic adherence. The results of this study indicated that the observation group receiving continuous nursing care one year after discharge had significantly lower anxiety and depression scores than the

conventional care group, suggesting that continuous nursing care can significantly reduce patients' negative emotions and is more conducive to their recovery.

This study used a rigorous approach to explore the impact of continuous nursing which align with the core principles of the biopsychosocial model. The questionnaire we used is simple, clear, and the scoring standard accurately records each variable of the patient. The multi-components of our intervention—combining regular telephone support, home visits, specialist consultations, and digital follow-up—created a comprehensive support system that addressed patients' psychological needs systematically. The operational details of our study, particularly the structured scheduling and the standardized questionnaire during each contact, ensured consistent psychological monitoring and early intervention for emerging distress. This systematic approach explains the progressive improvement in emotional function scores across the 12-month follow-up period. What's more, the temporal pattern of improvements, with progressive enhancement across all measured domains throughout the 12-month period, supports the sustained psychological impact of continuous nursing care. This longitudinal benefit underscores the importance of maintaining structured psychological support beyond the immediate post-discharge period for patients dealing with metastatic cancer.

Continuous nursing care interventions, providing comprehensive nursing services to patients with GC lung metastasis through various methods and pathways, with a greater emphasis on patient-centered nursing service concepts. These measures contributed to the rehabilitation of patients and reduce their readmission rate.

The significant improvements observed across all psychological and QoL dimensions in the continuous nursing group demonstrate a clear interrelationship between these variables. As patients' fears and depressive symptoms alleviated through sustained support, their overall emotional well-being naturally improved, creating a positive feedback loop [22].

The notable improvements in physical and role function can be directly linked to the psychological changes. With reduced anxiety levels, patients likely experienced less psychosomatic symptom burden and demonstrated increased motivation to engage in daily activities and fulfill social roles [23,24]. The psychological security established through regular contact enabled patients to gradually resume normal functions they had previously avoided due to disease-related apprehension.

Similarly, the cognitive function improvements align closely with the psychological outcomes. The alleviation of anxiety and depression likely reduced the cognitive load associated with disease-related worry, freeing mental resources for better concentration, memory, and clear thinking. Patients experiencing less psychological distress showed markedly better cognitive performance, suggesting that emotional states directly influence cognitive capacity in this population [25].

The social function enhancements further reflect the psychological transformations. As anxiety and depression decreased, patients demonstrated increased willingness and ability to participate in social activities and maintain relationships [26]. The psychological support provided through multiple channels helped rebuild social confidence that had been compromised by the disease experience.

Integrating the continuous nursing model into existing healthcare systems presents both clinical necessity and practical feasibility. The successful

implementation requires establishing continuous nursing as a standard component within oncology care pathways. This integration would involve developing structured handover protocols to ensure seamless transitions from inpatient to community care settings, establishing nurse-led clinics for systematic follow-up assessments [27] and patient education, and creating digital integration of patient records across hospitals and primary care to maintain continuity of care.

The effectiveness of continuous nursing fundamentally depends on adequate professional preparation and role development. This necessitates specialized training programs for nurses in oncology care, palliative support, and psychological intervention techniques [28,29], along with expanded responsibilities as care coordinators, especially in resource-constrained environments. Furthermore, fostering interprofessional collaboration among nurses, dietitians, physiotherapists, and social workers ensures comprehensive patient support.

Policy frameworks and reimbursement mechanisms provide essential foundation for sustainable implementation. This includes formal incorporation of continuous nursing into national cancer care guidelines, development of specific reimbursement codes for telehealth and home-based follow-up services, and establishment of performance-based incentives for institutions demonstrating improved patient-reported outcomes and reduced readmission rates.

One of the limitations of this study is the small sample size, which did not provide a more detailed segmentation of the patient population. For example, in China, the population structure is more rural than urban, and the implementation effect of continuous nursing care for different populations needs further research after expanding the sample size. Besides, the sample was from the same region of China, which means the results of this study need to be tested in larger, multi-center trials.

Despite these limitations, the study's findings are highly suggestive and internally valid. It offers a viable and effective model, while the specific model may need adaptation, the core concept is widely applicable. Other institutions can adapt and evaluate within their own contexts, contributing to the growing imperative to integrate comprehensive psychological and continuous care into standard oncology practice. Future implementations of continuous care can be significantly enhanced by integrating advanced digital tools and AI. By analyzing data from electronic health records and wearable devices, AI can generate predictive alerts to identify patients at high risk for complications or psychological distress, enabling proactive interventions [30]. This data can also fuel AI-driven personalization engines that dynamically tailor support materials—from dietary advice to psychological exercises—to each patient's evolving needs. Furthermore, intelligent conversational agents can provide 24/7 automated support, handling routine queries and initial symptom checks [31]. This creates a sophisticated “AI-human” hybrid model, where technology manages monitoring and personalization, allowing healthcare professionals to dedicate their expertise to complex clinical decisions and empathetic patient engagement.

5. Conclusion

In conclusion, this randomized controlled trial offers compelling evidence that a structured, multi-component continuous nursing care model is an effective, and

feasible intervention for mitigating the severe psychological distress and enhancing the multifaceted quality of life of patients with GC lung metastasis. By systematically addressing anxiety and depression and fostering improvements in physical, role, emotional, cognitive, and social functioning, this approach embodies a truly holistic and patient-centered strategy that significantly improves the overall care experience and outcomes for this vulnerable population. The model demonstrates high clinical value, strong patient acceptance, and significant potential for scalability. It should be seriously considered for integration into standard supportive care protocols in oncology, pending subsequent validation through larger, multi-center studies that also address economic and long-term outcomes.

Highlights

- Continuous nursing care significantly improves anxiety and depression in GC lung metastasis compared to routine care.
- Continuous nursing care significantly improves quality of life in GC lung metastasis compared to routine care.
- Continuous nursing care enhances rehabilitation outcomes and alleviates negative psychological states, demonstrating high clinical value.

Author contributions: Design the study, XL and YJ; collect the data, XL; analyze the data, XL; write the manuscript, XL; validate data, YJ; revise the manuscript, YJ. All authors have read and agreed to the published version of the manuscript.

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Ethical approval: The study was conducted under the Declaration of Helsinki guidelines; methods used in this study were in accordance with relevant regulations. The study was approved by the Ethics Committee of the First Hospital of China Medical University (No. 101022119). Prior to the study, the researcher provided participants with information about the study's purpose, significance, observation methods, as well as the obligations of the participants. Subsequently, written informed consent forms were signed by the participants. The names were anonymized with codes in the interview records and data analysis, ensuring the protection personal privacy.

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

Data availability statement: The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

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

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