

Article

Effect of comprehensive nursing and early enteral nutrition support in patients undergoing radical gastrectomy

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Abstract: Objective: To assess the impacts of comprehensive nursing alongside early enteral nutrition support on postoperative recovery and nutritional status of patients receiving radical gastrectomy for gastric cancer. **Methods:** One hundred patients who received radical gastrectomy for gastric cancer in our hospital from January 2022 to December 2023 were included and randomly divided into a study group (SG) and a control group (CG). The CG adopted routine nursing plus parenteral nutrition support. The SG adopted comprehensive nursing plus early enteral nutrition support. The postoperative recovery, degree of pain, nutritional status, immune function, incidence of complications, and quality of life, along with nursing satisfaction in 2 groups, were compared. **Results:** In comparison with the CG, the SG showed shorter postoperative hospitalization time, shorter first time of getting out of bed, shorter first time of anal exhaust, shorter recovery time of bowel sound, and shorter first time of defecation ($P < 0.05$). In comparison with the CG, the SG showed lower VAS scores ($P < 0.01$), higher TP, ALB, and PAB levels ($P < 0.05$), higher IgA, IgG, and IgM levels ($P < 0.05$), lower incidence of complications ($P < 0.05$), higher WHOQOL-BREF scores ($P < 0.05$), as well as higher nursing satisfaction ($P < 0.05$). **Conclusion:** Comprehensive nursing combined with early enteral nutrition support can accelerate the postoperative recovery and promote the nutritional status of patients receiving radical gastrectomy for gastric cancer.

Keywords: gastric cancer; radical gastrectomy; comprehensive nursing; early enteral nutrition; immune function

1. Introduction

Gastric cancer (GC), a very common malignant tumor resulting from the gastric mucosal epithelium, has a very high incidence, second only to lung cancer [1]. In recent years, with the continuous improvement of living standards, changes in people's living and eating habits, and increasing living pressure, the incidence of GC has exhibited a trend of increasing year by year [2]. The main clinical treatment of GC is radical gastrectomy. However, surgery will cause great trauma to patients, which will then affect the gastrointestinal function of patients, resulting in malnutrition and other symptoms in patients [3]. Therefore, effective nursing and nutritional intervention are very important in postoperative rehabilitation of patients with radical gastrectomy. In addition to the physical burden, major gastrointestinal surgery often leads to anxiety, reduced self-care confidence, and a decline in overall quality of life, making postoperative supportive care particularly important in GC patients [4].

Comprehensive nursing is a patient-centered, integrated nursing resource and means to provide patients with a comprehensive, continuous, and coordinated nursing service model. It breaks through the limitations of a single nursing method in traditional nursing and emphasizes multidisciplinary collaboration, holistic nursing

concepts, and comprehensive care of patients' physical, mental, and social spirit [5]. The advantages of comprehensive nursing include promoting the quality of care, enhancing patient satisfaction, and promoting the rational use of medical resources [6]. Recently, the application of comprehensive nursing has been widely reported in the nursing of many diseases. For instance, Xu et al. [7] suggested that comprehensive nursing plus respiratory functional exercises could enhance the pulmonary function, self-care capacity, and quality of life of patients suffering from pulmonary tuberculosis. Zhang et al. [8] indicated that comprehensive physical and mental nursing improved nursing satisfaction, quality of life, and psychological state of patients with acute cerebral infarction receiving intravenous thrombolysis. However, the influence of comprehensive nursing on postoperative recovery of patients receiving radical gastrectomy for GC is not clear. Given its focus on holistic physical and psychological support, comprehensive nursing may also help reduce postoperative emotional distress and improve rehabilitation motivation among GC patients [9].

Enteral nutrition and parenteral nutrition are two ways of postoperative nutritional support for surgical patients. Both can provide patients with substances such as calories and nitrogen, promote the recovery of positive nitrogen balance, improve the body's stress response, supplement nutrition, and reduce hypermetabolic reactions [10]. Recent studies have shown that parenteral nutrition can increase the burden on the liver of patients undergoing gastrointestinal surgeries such as GC after surgery, which is not conducive to the recovery of gastrointestinal function. In severe cases, complications such as enterogenic infection may also occur [11]. Enteral nutrition can not only protect the function and integrity of the gastrointestinal mucosal barrier but also meet the postoperative physiological needs of patients and correct their surgical trauma in a timely manner. After enteral nutrition support, the patient's body metabolism was regulated, the nutritional level and resistance were improved, and the inflammatory response was suppressed, laying a good foundation for postoperative recovery [12]. Meanwhile, enteral nutrition support can directly supply energy to the patient's intestines and regulate immune cells and lymphoid tissues, which is more beneficial for the patient's gastrointestinal function recovery, significantly reduces the risk of complications such as postoperative intestinal obstruction, and improves the safety of the surgery [13]. However, the application effect of comprehensive nursing combined with early enteral nutrition (EEN) support in patients receiving radical gastrectomy for GC is blurry. Because nutritional status is closely linked to psychological well-being and recovery confidence, combining EEN with comprehensive nursing may enhance both physiological repair and the patient's perceived recovery experience [14].

Consequently, the aim of this research was to explore the impacts of comprehensive nursing alongside EEN support on postoperative recovery and nutritional status of patients receiving radical gastrectomy for GC.

2. Data and methods

2.1. General data

One hundred patients who received radical gastrectomy for GC in our hospital from January 2022 to December 2023 were included as the study objects. The patients

were randomized 1:1 to a study group (SG) and a control group (CG) equally by a third-party doctor who did not take part in the later intervention. This third-party doctor opened sequentially numbered, sealed, opaque envelopes that were initially provided by an independent statistician. A single-blind method was adopted in this study, and the outcome evaluators were unaware of the grouping and allocation scheme.

The SG had 30 men and 20 women. The average age was (56.28 ± 5.18) years, ranging from 42 to 79 years. Tumor node metastasis (TNM) stages comprised stage I (21 cases), stage II (20 cases), and stage III (9 cases). The CG contained 31 males and 19 females. The average age was (56.35 ± 5.21) years, ranging from 41 to 78 years. TNM stages included stage I (22 cases), stage II (20 cases), and stage III (18 cases). No difference was reported in general data between 2 groups ($P > 0.05$). Inclusion criteria: (1) All subjects were validated by pathological biopsy as GC; (2) all received the same radical gastrectomy; (3) all patients were informed and signed consent. Exclusion criteria: (1) Other malignant tumors; (2) cognitive function and mental awareness disorders; (3) existence of surgical contraindications; (4) presence of diseases of the blood system or immune system.

2.2. Sample size

G*Power software was used for statistical analysis and sample size estimation [15], assuming that α (two-sided) = 0.05 and β = 0.1 (90% power). This estimation obtained a sample size of 100 patients.

2.3. Nursing methods

The CG received routine nursing as mentioned previously [16]; nurses strictly monitored and recorded the changes in patients' condition and vital signs such as blood pressure, heart rate, and respiration, gave routine health knowledge education, and explained postoperative precautions and dietary guidance to family members and patients.

The SG implemented comprehensive nursing.

(1) Health education. After the patients were diagnosed with GC, the patients and their families were given health education for 3 days at admission. Nurses made disease-related knowledge into health publicity brochures and videos for education and instructed family members and patients to read carefully to avoid adverse reactions and postoperative infection caused by lack of disease awareness. The nurses told the patients and their families to ask in time and explain in detail if they did not understand anything. After the operation, the nurses invited relevant experts to the hospital to explain the postoperative nursing content in detail so as to ensure that the patients and their families had a correct understanding of their own disease and postoperative nursing content.

(2) Postoperative psychological counseling. Three days after surgical treatment, nurses communicated with patients in time to understand the patients' inner thoughts, conducted in-depth communication, assessed the patients' psychological state, and provided targeted guidance to patients. After the patient's condition recovered, the nurses organized disease knowledge lectures according to the situation to promote the

patient's understanding of GC and timely informed the patient of the treatment process and improvement of the disease to help establish the confidence to cure the disease.

(3) Dietary guidance. Nurses made scientific and reasonable diet plans for patients and strictly controlled their diets. The patient transitioned from a liquid diet to a normal diet after surgery step by step. Nurses guided family members to prepare easily digestible and absorbable food for patients and strictly controlled the intake of sugar and protein food.

(4) Exercise guidance. On the first day after the operation, the nurses assisted the patients with physical exercise according to their physical recovery. From the second day after surgery, the nurse assisted the patient to carry out general activities, and the patient could resume outdoor activities slowly.

(5) Postoperative incision nursing. Nurses paid more attention to patients' incisions after surgery, helped patients change dressings in time, and avoided incision infection. During diet and exercise, nurses paid close attention to the incisions of patients and informed them to choose the semi-reclining position when eating. In addition, nurses needed to help patients turn over in time to avoid pressure sores and pneumonia. Nurses paid attention to the color and nature of the drainage fluid in the drainage tube, checked whether there was any situation such as tube withdrawal or leakage, and regularly helped patients to replace the drainage bag.

(6) Pain intervention. Surgical treatment was an invasive procedure that caused postoperative pain and required nurses to assess the degree of pain in patients. For patients who could tolerate mild pain, massage and music therapy were used to help alleviate pain. Patients with severe pain were intervened with analgesic drugs following the doctor's guidance.

2.4. Nutrition support methods

The CG accepted parenteral nutrition support. After the operation, the patients were given glucose, amino acids, trace elements, and another intake. The daily calorie intake was controlled at 125.97 kJ/kg, and the nitrogen content was controlled at 0.32 g/kg. After the recovery of intestinal function, the patient could transition from a liquid diet to a semi-liquid diet to a regular diet.

The SG adopted EEN support. The patient was given 0.9% 300 mL NaCl on the first day after surgery. About 500 mL of enteral nutrition emulsion (TDF-D) (Fresenius Kabi Deutschland GmbH, 500 mL/bag) was given to the patient on the 2nd day after surgery at a flow rate of 80 ~ 120 mL/h at a temperature of 36.5 ~ 41.7 °C. 1000 mL of enteral nutritional suspension (SP) (Nutricia Pharmaceutical (Wuxi) Co., LTD., 500 mL/bottle) was given on the 3rd to 7th day following surgery, the flow rate was 80 to 120 mL/h, and the temperature was 36.5 to 41.7°C. The gastric tube was removed after the anal exhaust, and a small amount of liquid food was taken through the mouth to reduce the injection volume of the jejunal tube. After the patient could eat liquid food normally, the nutrient tube was removed.

2.5. Observation indicators

(1) The postoperative hospitalization time, first time of getting out of bed, first time of anal exhaust, recovery time of bowel sound, and first time of defecation were

counted.

(2) Visual analogue scale (VAS) [17] was employed for evaluating the degree of pain of patients 6, 24, and 48 h following surgery. The higher the score was, the more severe the pain was.

(3) The nutritional status of patients was investigated, fasting venous blood was collected, and the level changes of total protein (TP), albumin (ALB), and prealbumin (PAB) were measured by automatic biochemical analyzer G92000.

(4) 5 mL of elbow venous blood was extracted from both groups, and serum immunoglobulin levels, including IgA, IgG, and IgM levels, were recorded in both groups.

(5) The incidence of postoperative complications, including reflux esophagitis, anastomotic fistula, duodenal stump fistula, pulmonary infection, and urinary tract infection, was analyzed.

(6) Quality of life: The World Health Organization Quality of Life Questionnaire (WHOQOL-BREF) [18] was evaluated from four dimensions: physiology, psychology, social relationship, and environment. The total score of each dimension was 100 points, and the scores were positively correlated with the patients' quality of life.

(7) The nursing satisfaction rate of patients was compared, and the self-developed questionnaire of the two groups was selected to analyze the nursing satisfaction. <70 points indicated dissatisfaction, 70 ~ 85 points indicated relative satisfaction, and >85 points indicated very high satisfaction. Total nursing satisfaction rate = (very satisfied + relatively satisfied)/total number of cases $\times$ 100%.

2.6. Statistical analysis

Utilizing SPSS 24.0 statistical software, data analysis was implemented. Measurement data were exhibited as ($\bar{x} \pm s$), followed by comparison using a *t*-test. Count data were exhibited as (*n*, %), followed by comparison using the χ^2 test. *P* < 0.05 meant the difference was statistically significant.

3. Results

3.1. Postoperative recovery

In comparison with the CG, the SG had shorter postoperative hospitalization time, shorter first time of getting out of bed, shorter first time of anal exhaust, shorter recovery time of bowel sound, and shorter first time of defecation (*P* < 0.05, **Figure 1**).

3.2. VAS score

In comparison with the CG, the VAS score in the SG presented lower (*P* < 0.01, **Figure 2**).

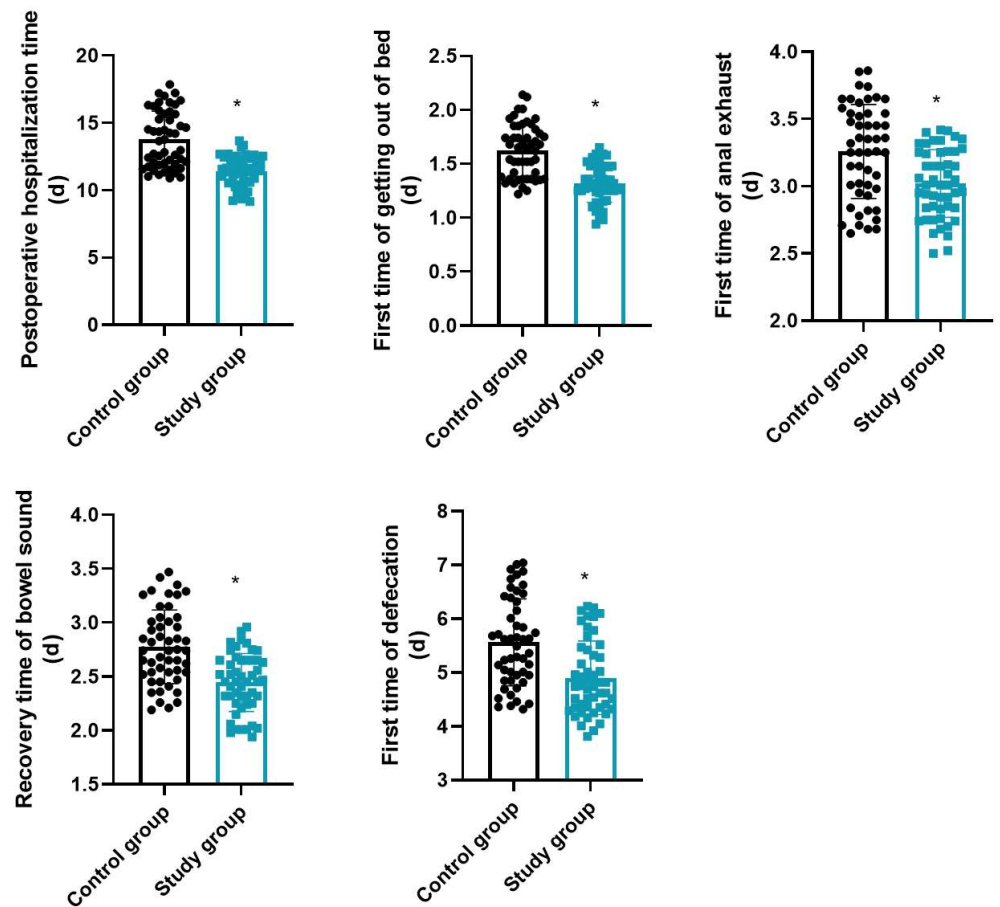


Figure 1. Postoperative recovery in 2 groups.

* $P < 0.05$.

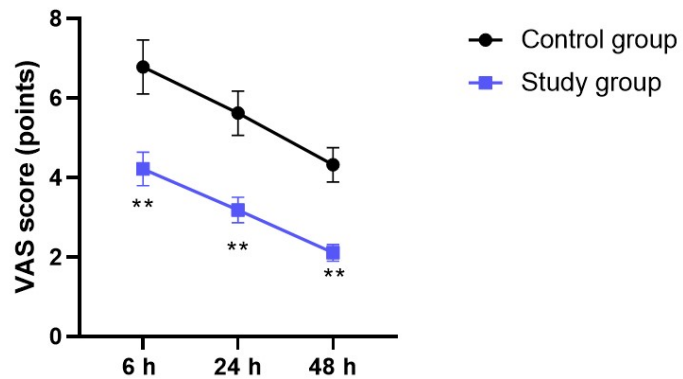


Figure 2. VAS score in 2 groups.

** $P < 0.01$.

3.3. Nutritional status

Before intervention, no difference was seen in TP, ALB, and PAB levels between the 2 groups ($P > 0.05$). Following intervention, both groups reported elevated levels of the above indicators. In comparison with the CG, the SG had higher levels of the above indicators following intervention ($P < 0.05$, **Figure 3**).

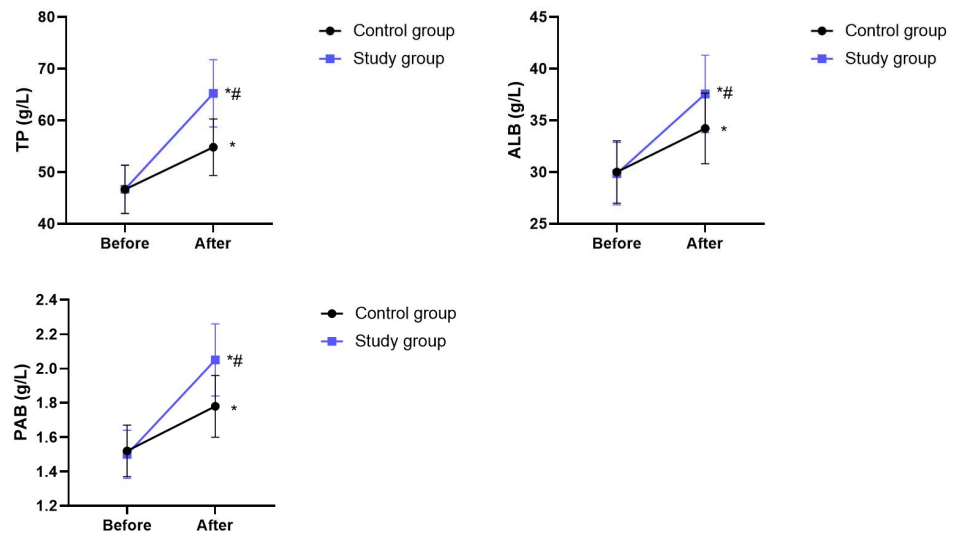


Figure 3. Nutritional status in 2 groups.

* $P < 0.05$, vs. before intervention; # $P < 0.05$, vs. CG.

3.4. Immune function

Before intervention, no difference was seen in IgA, IgG, and IgM levels between the 2 groups ($P > 0.05$). Following intervention, both groups reported elevated levels of the above indicators ($P < 0.05$). In comparison with the CG, the SG had higher levels of the above indicators following intervention ($P < 0.05$, **Figure 4**).

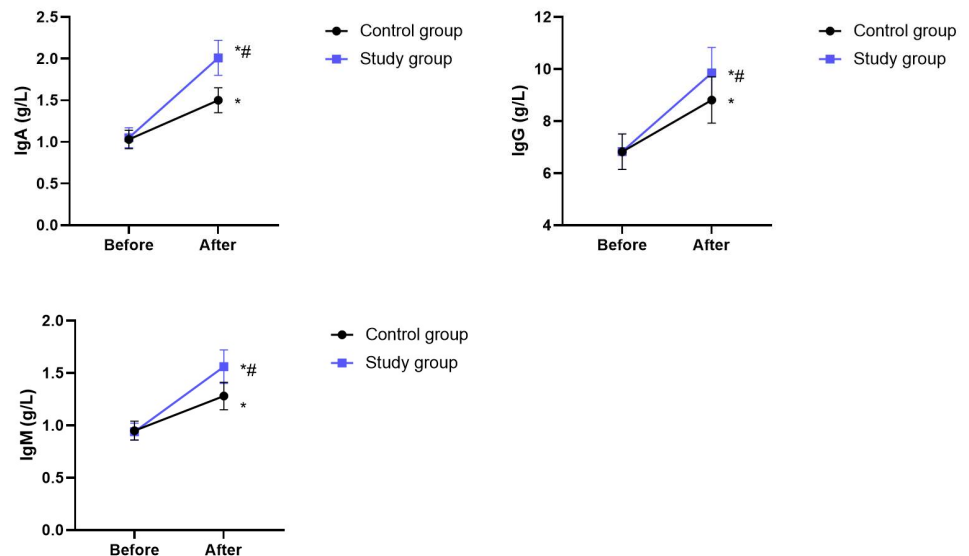


Figure 4. Immune function in 2 groups.

* $P < 0.05$, vs. before intervention; # $P < 0.05$, vs. CG.

3.5. Incidence of complications

The CG had 2 cases of reflux esophagitis, 2 cases of anastomotic fistula, 1 case of duodenal stump fistula, 2 cases of pulmonary infection, and 2 cases of urinary tract infection. The total incidence rate was 18.00% (9/50). In the SG, there was 1 case of reflux esophagitis as well as 1 case of duodenal stump fistula. The total incidence rate was 4.00% (2/50). In contrast to the CG, the SG had a lower total incidence of complications ($P < 0.05$, **Table 1**).

Table 1. Incidence of complications in 2 groups.

Groups	N	Reflux esophagitis	Anastomotic fistula	Duodenal stump fistula	Pulmonary infection	Urinary tract infection	Total incidence rate
Control group	50	2 (4.00)	2 (4.00)	1 (2.00)	2 (4.00)	2 (4.00)	9 (18.00)
Study group	50	1 (2.00)	0 (0.00)	1 (2.00)	0 (0.00)	0 (0.00)	2 (4.00)
χ^2							5.005
P							0.025

3.6. Quality of life

Before intervention, no difference was reported in WHOQOL-BREF scores between 2 groups ($P > 0.05$). Following intervention, WHOQOL-BREF scores were elevated in 2 groups ($P < 0.05$). In comparison with the CG, the SG had higher WHOQOL-BREF scores following intervention ($P < 0.05$, **Figure 5**).

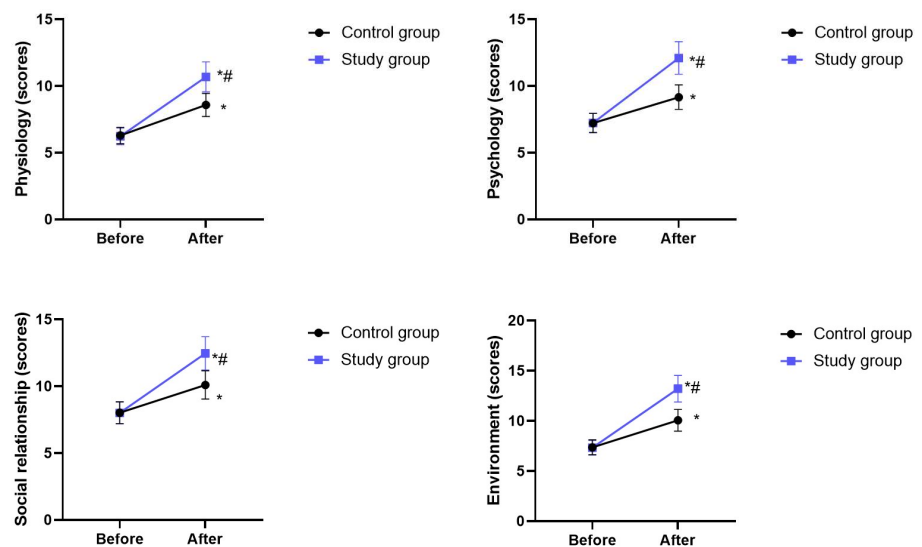


Figure 5. Quality of life in 2 groups.

* $P < 0.05$, vs. before intervention; # $P < 0.05$, vs. CG.

3.7. Nursing satisfaction

In the CG, 24 patients were very satisfied with the care, 16 patients were satisfied with the care, and 10 patients were dissatisfied with the care, and the total satisfaction rate was 80.00% (40/50). In the OG, 30 patients were very satisfied with the care, 18 patients were satisfied with the care, and 2 patients were dissatisfied with the care, and the total satisfaction rate was 96.00% (48/50). In contrast to the CG, the SG had better nursing satisfaction ($P < 0.05$, **Table 2**).

Table 2. Nursing satisfaction in 2 groups.

Groups	Cases	Very satisfied	Relatively satisfied	Dissatisfied	Total satisfaction rate
Control group	50	24 (48.00)	16 (32.00)	10 (20.00)	40 (80.00)
Study group	50	30 (60.00)	18 (36.00)	2 (4.00)	48 (96.00)
χ^2					6.061
P					0.013

4. Discussion

With the continuous advancement of China's economic level, people's living standards have been improved, making certain changes in diet structure and living habits, which causes the incidence of GC to be higher and higher [19]. Under the influence of factors such as the change of modern lifestyle and the increasing pressure of life, GC patients gradually show a trend of younger age [20]. In addition, because GC has no apparent clinical symptoms in the early stage, it is often easy to be confused with other gastric diseases, which seriously affects the treatment of patients once it is found that GC has entered the middle and advanced stages [21]. Currently, the main therapeutic regimens for GC include surgery and chemotherapy [22]. However, both treatment methods will have certain physical and psychological effects on patients. In addition, the gastrointestinal function of GC patients is poor, which affects the body's immune system and increases the susceptibility to the disease [23]. These physiological burdens often coexist with anxiety, postoperative fear, and reduced confidence in rehabilitation, highlighting the importance of supportive nursing during recovery [24]. In addition, the psychological pressure on patients is too large, which affects the follow-up treatment effect and reduces patients' quality of life [25]. Consequently, it is essential to take effective and scientific nursing measures to minimize patients' physical and mental pressure to the greatest extent and ensure patients' quality of life.

Comprehensive nursing refers to the systematization of nursing procedures, the formulation of standardized nursing plans, the strict control of nursing quality, and the interlocking of nursing contents to improve the level and effect of nursing services [26]. Comprehensive nursing intervention is a new nursing concept optimized from the conventional nursing model. In the nursing process, the overall situation of patients will be comprehensively evaluated, and nursing measures will be improved and optimized according to the evaluation results to provide patients with high-quality and efficient nursing services [27]. By incorporating structured communication, timely psychological reassurance, and targeted health education, comprehensive nursing can also subtly enhance patients' emotional stability and participation in postoperative care, complementing its physiological benefits [28].

Following radical gastrectomy for GC, only a small part of the stomach remains in the patient, which leads to a decrease in the patient's eating tolerance and also affects the patient's nutrient absorption [29]. Therefore, nutritional intervention is very important in postoperative rehabilitation of patients with radical gastrectomy for GC. Nutritional support is divided into two types, parenteral nutrition support and enteral nutrition support, respectively; the former can be adjusted according to the specific conditions of patients [30]. However, parenteral nutrition support is relatively expensive and not within the range of all patients [31]. At the same time, parenteral nutrition support will cause certain irritation to the patient's body, which is easy to cause a series of complications [32]. On the basis of providing nutrition to patients, EEN support can directly absorb nutrients through the intestine, which has a high nutrient utilization rate and is more consistent with the physiological structure of the human body [33]. It is not only relatively convenient for administration but also low in cost, which is helpful to keep the integrity of intestinal mucosal structure [34]. Better

nutritional status may also indirectly support psychological well-being by reducing fatigue and enhancing patients' confidence in recovery [35].

In our research, the results displayed in comparison with the CG, the SG had shorter postoperative hospitalization time, shorter first time of getting out of bed, shorter first time of anal exhaust, shorter recovery time of bowel sound, and shorter first time of defecation, as well as a lower VAS score, implying that comprehensive nursing combined with EEN support could accelerate the postoperative recovery and relieve the degree of pain of patients receiving radical gastrectomy for GC. In line with our findings, Bo et al. suggested that postoperative EEN could better restore intestinal barrier function of patients undergoing esophagectomy compared to parenteral nutrition [36]. Besides, Zhong et al. [37] proposed that a comprehensive nursing program significantly shortened the recovery time of patients requiring laparoscopic treatment. The reason analysis believed that it was related to comprehensive nursing to guide patients to exercise as soon as possible and scientific dietary guidance to restore their normal diet as soon as possible. In addition, effective postoperative analgesia intervention also promoted the physical recovery of patients. At the same time, EEN support has the following advantages [13]: (1) It can help the synthesis of visceral protein, shorten the time of postoperative intestinal function recovery and postoperative fever; (2) it can reduce the damage to intestinal mucosa; (3) it is more in line with the physiological state of the body, can reduce the impact on the circulatory system, and reduce the postoperative exhaust time; (4) it is easy to operate, reduces hospitalization costs, and shortens hospitalization time.

Besides, our research manifested that, in contrast to the CG, the SG had higher TP, ALB, and PAB levels and higher IgA, IgG, and IgM levels following intervention. All these findings suggested that comprehensive nursing combined with EEN support could promote the nutritional status and immune function of patients receiving radical gastrectomy for GC. Lower pain levels can also reduce postoperative tension and discomfort, contributing to a more positive recovery experience [38]. The reason may be that the nutrition provided by enteral nutrition has less fat content, which can be directly absorbed by patients, which helps patients obtain nutrients and enhances the body's immunity [39]. Consistently, Li et al. [40] suggested that EEN support could improve the nutrition and immune function of patients receiving radical rectal cancer surgery. Ma et al. indicated that a postoperative EEN program could diminish the incidence of postoperative complications and enhance the immune function of cholangiocarcinoma patients suffering from malignant obstructive jaundice [41]. Improved immunity and better physical status often reassure patients and reduce postoperative worry, supporting smoother psychological adjustment [42].

Another finding of our research was that, in contrast to the CG, the SG showed a lower incidence of complications, higher WHOQOL-BREF scores, and better nursing satisfaction, suggesting that comprehensive nursing combined with EEN support could diminish the incidence of complications, promote the quality of life, and elevate the nursing satisfaction of patients undergoing radical gastrectomy for GC. Quality of life improvements reflect not only physiological recovery but also better emotional comfort, enhanced confidence, and increased trust in the care process [43]. Similarly, Fujita et al. indicated that EEN reduced the incidence of life-threatening complications during thoracic esophagectomy [44]. Yang et al. [45] proposed comprehensive

intervention could facilitate the life quality of elderly patients suffering from Alzheimer's disease. The reason was that exercise could improve the speed of intestinal peristalsis of patients, accelerate the recovery of gastrointestinal function, diminish the occurrence of postoperative complications, and speed up the recovery process of patients. Moreover, the EEN support program can reduce the stimulation of enteral nutrient solution to the anastomosis, regulate the balance of intestinal flora, simplify feeding operations, improve the damaged condition of the body, provide sufficient nutrients for the recovery of the body, improve the physique of patients, and thus reduce the occurrence of complications [46].

However, there are some deficiencies in our study. Firstly, the present study was implemented at a single center and included a small sample size, a factor that could potentially compromise the validity and generalizability of our research outcomes. Secondly, this study did not conduct follow-up, and the long-term effect of comprehensive nursing combined with EEN support on patients receiving radical gastrectomy is still unclear. In addition, this study was single-blind, which may have biased the results. Consequently, it is essential to enlarge the sample size, implement multi-center studies, and extend the study time in future research to further explore the effect of comprehensive nursing combined with EEN support on patients with radical gastrectomy for GC.

5. Conclusion

Comprehensive nursing combined with EEN support can accelerate the postoperative recovery and promote the nutritional status of patients receiving radical gastrectomy for GC. Beyond physical recovery, this integrated approach also provides patients with greater comfort, reassurance, and confidence during rehabilitation, which may contribute to better overall well-being and quality of life. Our study may provide a promising clinical reference for nursing and nutrition support in patients undergoing radical gastrectomy for GC. Future research exploring psychological outcomes and long-term quality-of-life changes may further clarify the broader benefits of this care model.

Author contributions: Study conception, HZ and HW; design, HZ and HW; data collection, HZ and HW; analysis and interpretation of results, HZ and HW; draft manuscript preparation, HZ and HW; review and editing, HZ and HW. All authors have read and agreed to the published version of the manuscript.

Institutional review board statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of The First Affiliated Hospital of Soochow University, and the protocol code was (2024)-L-005.

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

Availability of data and materials: The data that support the findings of this study are available from the Corresponding Author [Wang H], upon reasonable request.

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

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