International Surgery

Investigating the Impact of Early Mobilization and Enteral Nutrition Suspension on Postoperative Nutritional Status in Gastric Cancer Patients

--Manuscript Draft--

Manuscript Number:	INTSURG-D-24-00023
Full Title:	Investigating the Impact of Early Mobilization and Enteral Nutrition Suspension on Postoperative Nutritional Status in Gastric Cancer Patients
Article Type:	Original Article
Keywords:	Early mobilization; Postoperative gastric cancer; Enteral nutrition; Nutritional status
Corresponding Author:	Fang Li Anqing Municipal Hospital Anqing, CHINA
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	Anqing Municipal Hospital
Corresponding Author's Secondary Institution:	
First Author:	Fang Li
First Author Secondary Information:	
Order of Authors:	Fang Li
	Caixia Wang
	Changzheng Chen
Order of Authors Secondary Information:	
Abstract:	Objective: This study aimed to evaluate the effects of early mobilization combined with enteral nutrition suspension on the nutritional status of gastric cancer patients post-surgery. Methods: Ninety patients who underwent radical gastrectomy between December 2020 and May 2023 were randomly divided into an observation group and a control group. Both groups received standard postoperative care, including infection prevention, gastrointestinal decompression, and fluid/electrolyte balance. The control group started enteral nutrition on the first day post-surgery, while the observation group also engaged in early mobilization. Recovery outcomes such as first defecation time, fluid intake time, first exhaust time, and hospital stay were tracked, along with serum nutrition indicators and adverse reactions. Results: The observation group had significantly shorter first defecation, exhaust time, fluid intake, and hospital stay compared to the control group ($P<0.05$). By day 8, both groups showed increased levels of PAB, Alb, and TRF compared to day 1, with the observation group having significantly higher levels ($P<0.05$). Adverse reaction rates were 17.8% and 15.6%, respectively, with no statistically significant difference ($P>0.05$). Conclusion: Early mobilization combined with enteral nutrition suspension enhances postoperative and nutritional recovery in gastric cancer patients undergoing radical gastrectomy and is a safe and effective approach.

Investigating the Impact of Early Mobilization and Enteral Nutrition Suspension on Postoperative Nutritional Status in Gastric Cancer Patients

Fang Li,Caixia Wang,Changzheng Chen

Department of Hepatobiliary and Gastrointestinal Surgery,Anqing Municipal Hospital,246003,Anqing City,Anhui Province,China

***Corresponding Author:**Fang Li

Email： 15922362569@163.com

Abstract

Objective This study sought to examine how early mobilization combined with enteral nutrition suspension affects the nutritional status of patients with gastric cancer following surgery. *Methods* Ninety patients who underwent radical gastrectomy for gastric cancer at our hospital between December 2020 and May 2023 were randomly allocated to either an observation group or a control group. Both groups received standard postoperative care, including infection prevention, gastrointestinal decompression, and maintenance of fluid and electrolyte balance. The control group received enteral nutrition support starting from the first day after surgery, and outcomes were evaluated after 8 days of support. The observation group received early mobilization in addition to standard care. Recovery parameters such as first defecation time, fluid intake time, first exhaust time, and hospital stay were monitored, along with serum nutrition indicators and incidence of adverse reactions during enteral nutrition support. *Results:* The observation group had significantly shorter first defecation time, first exhaust time, fluid intake time, and hospital stay than the control group, with statistically significant differences (P<0.05). On postoperative day 8, both groups demonstrated elevated PAB, Alb, and TRF levels compared to postoperative day 1. Furthermore, the observation group had significantly higher levels than those of the control group, with a statistically significant difference (P<0.05). The occurrence of adverse reactions between the two groups was 17.8% and 15.6%, respectively, but the difference was found to be not statistically significant (P>0.05). *Conclusion:* Early mobilization combined with enteral nutrition suspension promotes early postoperative and nutritional recovery in gastric cancer patients undergoing radical gastrectomy. This approach is deemed safe and may offer valuable benefits in optimizing patient outcomes.

Key words： Early mobilization; Postoperative gastric cancer; Enteral nutrition; Nutritional status;

Introductions

Gastric cancer, a highly lethal malignancy, predominantly affects the middle-aged and elderly population [1]. Radical surgery stands as a cornerstone in the treatment of gastric cancer, offering the potential to remove the lesion and control disease progression effectively [2]. Over time,

advancements in surgical techniques and nutritional support have significantly improved the postoperative survival rates of gastric cancer patients. However, the recovery of postoperative nutritional status remains a critical concern for both clinicians and patients[3-4].

Traditional postoperative nutritional support strategies primarily involve enteral nutrition and parenteral nutrition, yet these approaches come with certain limitations [5-6]. Enteral nutrition often requires a prolonged period for intestinal peristalsis to recover fully, and achieving complete enteral nutritional intake can be challenging. On the other hand, parenteral nutrition necessitates the insertion of a central venous catheter, posing risks such as infection, vascular injury, and venous thrombosis[7].

Emerging evidence suggests that early mobilization combined with the use of mixed enteral nutrition suspensions can significantly enhance postoperative recovery in gastric cancer patients [8-9]. Early mobilization facilitates the restoration of intestinal peristalsis, reduces the risk of deep venous thrombosis, enhances physical activity levels, and promotes nutrient absorption and metabolism [10]. Mixed enteral nutrition suspensions fulfill the postoperative nutritional requirements of gastric cancer patients, delivering adequate nutritional substances and amino acids to support protein synthesis and tissue repair during the recovery phase [11].

However, there is currently limited research on the recovery of postoperative nutritional status in gastric cancer patients with early mobilization combined with enteral nutrition mixed suspensions. The sample sizes in existing studies are small, leading to large disparities in research outcomes and a lack of unified standards and guidance. Therefore, it is imperative that we conduct more comprehensive and stringent research to assess the impact of integrating early mobilization and enteral nutrition mixed suspensions for postoperative patients. This endeavor holds significant importance for optimizing clinical postoperative recovery programs, enhancing patient survival rates and quality of life. Furthermore, it serves to advance research and technological progress in the field of nutritional support.

Materials and Methods

Research objects

The study population for this research comprised 90 patients who underwent radical gastrectomy at our hospital during the period from December 2020 to May 2023. A random allocation approach was used to divide the patients into two groups: the control group and the observation group. The observation group included 25 males and 20 females who were 65.36 ± 5.38 years old on average, and the control group included 28 males and 17 females. The general characteristics of the observation and control groups were similar, with no statistically significant differences found between the two groups ($P>0.05$), ensuring comparability. The study received approval from the Ethics Committee of the hospital, and all patients were required to provide informed consent.

Selection criteria

Inclusion criteria: (1) age ≥ 18 years, regardless of gender; (2) underwent radical gastrectomy and met the diagnostic criteria for gastric cancer in the "Expert Consensus on Diagnosis and Treatment of Gastric Cancer in China (2020 edition)" [12]; (3) capable of receiving enteral nutritional support on the third day after surgery; (4) had a complete basic life support system and could receive nutritional support during their hospital stay; (5) had no preoperative complications of hypertension, hepatic or renal dysfunction, or significant pulmonary function limitations. Exclusion criteria: (1) patients who developed systemic infiltration (including rectal, mesenteric, and other visceral

involvement) or distant metastasis during surgery; (2) patients with severe cardiac, pulmonary, hepatic, or renal dysfunction; (3) patients with eating disorders caused by rare or allergic conditions; (4) patients with acid-base imbalances before or after surgery; (5) patients with obvious cerebral dysfunction or abnormal neuroimmune regulation.

Methods

Both groups of patients received basic treatments, such as prevention of infection, gastrointestinal decompression, maintenance of water and electrolyte balance, and acid-base balance, after surgery. The control group had a liquid-filled jejunal tube placed before surgery, and then the tube was positioned below the anastomosis output on the duodenum 30 cm. Nepro, a protein-based enteral nutrition supplement produced by Nutricia, was administered as nutritional support, beginning on the second day of surgery. On the first day after the operation, patients were given 500 mL of normal saline intravenously. The initial dose was 1000 ml/day with a rate of 30 ml/h. The amount administered was raised gradually to 1500 ml/day at 100 ml/h over the course of 2-3 days. The effect of enteral nutritional support was observed for 8 days. The basic treatments administered to the control group were supplemented with early mobilization for patients in the observation group. The patients started early mobilization training on the second day after surgery, gradually increasing the duration of activity, with vital sign monitoring throughout the training process. The therapeutic effect was observed after 8 days of treatment.

Observation indicators and judgment criteria

The observation indicators and methods included: (1)Recovery status, including the time of first defecation, time of first passing gas, time of oral feed initiation, and length of hospital stay; (2) Fasting venous blood samples were taken from patients in both groups to measure prealbumin (PAB), albumin (Alb), and transferrin (TRF) levels in serum before and after treatment. Blood was collected on the day before surgery and on the 8th day post-surgery; and (3) Incidence of adverse reactions during enteral nutritional infusion, with daily monitoring of the occurrence of abdominal distension, abdominal pain, nausea, and vomiting among patients in both groups.

Statistical analysis

The presentation of continuous data was accomplished via x ±s notation. Intergroup comparison was accomplished employing independent sample t-tests, while paired t-tests were implemented to determine any changes within each group. Results with a *P*-value of ≤0.05 were recognized as statistically significant. Statistician utilized SPSS22.0 software.

Results

Postoperative recovery

Postoperative recovery parameters were compared between the control and observation groups. In the observation group, the first defecation time was significantly shorter compared to the control group (2.47 ± 0.53 days vs. 3.15 ± 0.48 days, p = 0.000) (Table 1). Similarly, the observation group demonstrated a shorter first exhaust time than the control group (1.82 ± 0.39 days vs. 2.74 ± 0.49 days, p = 0.000) (Table 1). The time to start a liquid diet was also significantly shorter in the observation group compared to the control group (6.54 ± 0.33 days vs. 7.63 ± 0.34 days, p = 0.028) (Table 1). Additionally, the observation group had a shorter hospitalization time compared to the control group (18.72 ± 3.10 days vs. 23.38 ± 4.29 days, p = 0.000) (Table 1). These findings suggest that the time to the first defecation, time to the initiation of oral feeding, time to the first passing of gas, and length of hospital stay were all significantly shorter in the observation group compared to

the control group ($P < 0.05$).

Table 1. Postoperative recovery

Group	First defecation time	First exhaust time	The time to start a liquid diet	Hospitalization time
Control (45)	3.15±0.48	2.74±0.49	7.63±0.34	23.38±4.29
Observation (45)	2.47±0.53	1.82±0.39	6.54±0.33	18.72±3.10
t	5.729	5.287	8.239	7.481
P	0.000	0.000	0.028	0.000

Nutritional status

Before treatment, there were no significant differences between the groups in terms of Prealbumin (PAB) levels, Albumin (Alb) levels, and Transferrin (TRF) levels. In the control group, following treatment, significant increases were observed in PAB (from 208.16±25.38 mg/L to 236.86±28.44 mg/L), Alb (from 31.91±4.72 g/L to 35.38±6.31 g/L), and TRF (from 1.57±0.28 g/L to 2.01±0.40 g/L) levels (all $p < 0.05$) (Table 2). Similarly, in the observation group, after treatment, significant increases were observed in PAB (from 210.74±24.93 mg/L to 260.52±30.97 mg/L), Alb (from 32.56±4.88 g/L to 39.79±6.56 g/L), and TRF (from 1.50±0.26 g/L to 2.46±0.47 g/L) levels (all $p < 0.05$) (Table 2). Moreover, after treatment, the observation group exhibited significantly higher post-intervention PAB, Alb, and TRF levels compared to the control group (all $p < 0.05$), indicating a more pronounced improvement in nutritional status following the intervention (Table 2).

Table 2. Nutritional status

Group	Time	PAB (mg/L)	Alb (g/L)	TRF (g/L)
Control	Before	208.16±25.38	31.91±4.72	1.57±0.28
	After	236.86±28.44[a]	35.38±6.31[a]	2.01±0.40[a]
Observation	Before	210.74±24.93	32.56±4.88	1.50±0.26
	After	260.52±30.97[ab]	39.79±6.56[ab]	2.46±0.47[ab]

[a]$P<0.05$, a statistically significant difference compared to before treatment; [b]$P<0.05$, compared to the control group, the difference is statistically significant

Incidence of adverse reactions

Adverse reactions were observed in both the control and observation groups, occurring over 8 days following surgery (Table 3). The control group experienced eight events: three cases of abdominal distension, two cases of abdominal pain, and three cases of nausea and vomiting (Table 3). The observation group encountered seven incidents: two cases of abdominal distension, three cases of abdominal pain, and two cases of nausea and vomiting. Nevertheless, the difference between proportions of adverse reactions in the control (17.8%) and observation groups (15.6%) was not statistically significant (Table 3).

Table 3 Occurrence of adverse reactions

Group	Ventosity	Abdominal pain	Nausea amd Vomiting	Total
Control (45)	3	2	3	8 (17.8)
Observation (45)	2	3	2	7 (15.6)
χ^2				0.080
P				0.77

Discussion

The Enhanced Recovery After Surgery (ERAS) approach views post-operative early mobilization as a critical element. Notably, early mobilization has been shown to lessen the incidence of gastric complications, facilitate the restoration of intestinal function, and improve outcomes among gastric surgery patients[10].

The study's findings revealed that integrating early mobilization with enteral nutrition suspension facilitated prompt recovery and nutritional restoration following gastric cancer surgery. Early mobilization, aligning with human anatomical and physiological principles, bolstered physical function restoration and contributed to optimal patient health. Results indicated that enteral nutrition suspension played a critical role in meeting patients' nutritional requirements post-surgery. Furthermore, the study suggested that optimizing nutritional supplementation was essential for expediting patient physical recovery. In comparison to the control group, patients in the observation group showed slight improvements in PAB, Alb, and TRF levels one week post-surgery, indicating enhanced nutritional intake during the recovery period. The incidence of adverse reactions did not significantly differ between the two groups, suggesting the safety of early mobilization combined with enteral nutrition suspension application. However, seven cases of adverse reactions in the observation group highlight unresolved concerns. Given the study's limited scope, further extensive randomized controlled trials are necessary to thoroughly assess the safety and efficacy of this combined treatment approach.

Additionally, it is noteworthy that this study had a limited research duration, only evaluating patients for 8 days post-surgery. Consequently, the findings may not fully represent the long-term recovery status following surgery. Future research endeavors should aim to comprehensively assess the long-term recovery effects of early mobilization combined with enteral nutrition suspension and delve deeper into optimizing treatment plans for enhanced therapeutic outcomes. Furthermore, based on the survey results, qualitative research should be conducted to explore the self-management abilities of gastric cancer patients post-surgery and evaluate the support they require. This qualitative approach can provide valuable insights into patient needs and inform the development of tailored support strategies to optimize postoperative care.

In conclusion, this research suggests that early mobilization combined with enteral nutrition suspension can facilitate early recovery and nutritional restoration following gastric cancer surgery, with demonstrated safety. However, further research is warranted to evaluate the long-term recovery effects and optimize treatment plans. Such endeavors are crucial for aiding patients in achieving their optimal physical and mental well-being post-surgery.

References

[1] Shinohara H, Kurahashi Y, Haruta S, et al.Universalization of the operative strategy by

systematic mesogastric excision for stomach cancer with that for total mesorectal excision and complete mesocolic excision colorectal counterparts[J],2018.
[2] Cheng Y, Zhang J, Zhang L, et al.Enteral immunonutrition versus enteral nutrition for gastric cancer patients undergoing a total gastrectomy: a systematic review and meta-analysis[J].*BMC Gastroenterol*,2018, **18** (1): 11.
[3] Guo Z Q, Yu J M, Li W, et al.Survey and analysis of the nutritional status in hospitalized patients with malignant gastric tumors and its influence on the quality of life[J].*Support Care Cancer*,2020, **28** (1): 373-380.
[4] Yang W, Zhou M, Li G, et al.Preoperative Chemoradiotherapy Versus Postoperative Chemoradiotherapy for Patients With Locally Advanced Gastric Cancer: A Retrospective Study Based on Propensity Score Analyses[J].*Front Oncol*,2020, **10**: 560115.
[5] Xie Lina, Yu Ling, Wang Dongxue, et al. Cost effectiveness analysis of individualized and premixed parenteral nutrition formulas for perioperative nutritional support in gastrointestinal tumors [J]. *Chinese Journal of Cancer Prevention and Treatment*, 2018,**25** (24): 4
[6] Lin Zechen. Research progress on perioperative enteral nutrition support therapy for gastric cancer [J]. *Zhejiang Medical Journal*, 2019,**41** (13): 4
[7] He Chenglong, Zan Jianbao, Song Kangjie, et al. Observation of the effect of early sequential enteral nutrition support after upper gastrointestinal perforation surgery [J]. *Journal of the People's Liberation Army Medical College*, 2020 **(9)**: 4
[8] Liu Tingting, Chen Min, Shen Ling. Construction and diagnostic efficacy evaluation of a safety assessment tool for early postoperative ambulation in patients with digestive system cancer [J]. *Journal of Nursing of the People's Liberation Army*, 2020,**37** (8): 4
[9] Wang Erying, Zheng Liqian, Pan Xuan. Analysis of early postoperative ambulation and related risk factors in patients undergoing gastric cancer surgery [J]. *Medical Equipment*, 2022 (**019**): 035
[10] Wang Xiaoyue, Zhou Ning, Liu Wei. Analysis of influencing factors on postoperative gastrointestinal function recovery in gastric cancer patients [J]. *Cancer Progress*, 2020,**18** (1): 3
[11] Lv Xiaoqin, Wang Jiajia, Jin Yuhan, et al. The application effect of different initial concentrations of enteral nutrition solutions in postoperative enteral nutrition for gastric cancer radical surgery [J]. *Jilin Medical Journal*, 2022,**43** (10): 5
[12] Gastric Cancer Professional Committee of China Anti Cancer Association. Chinese Expert Consensus on Difficulties in Diagnosis and Treatment of Gastric Cancer (2020 Edition) [J]. *Chinese Journal of Practical Surgery*, 2020 (**8**)

Title page

Investigating the Impact of Early Mobilization and Enteral Nutrition Suspension on Postoperative Nutritional Status in Gastric Cancer Patients

Fang Li,Caixia Wang,Changzheng Chen

Department of Hepatobiliary and Gastrointestinal Surgery,Anqing Municipal Hospital,246003,Anqing City,Anhui Province,China

***Corresponding Author:**Fang Li

Email： 15922362569@163.com

Table 1. Postoperative recovery

Group	First defecation time	First exhaust time	The time to start a liquid diet	Hospitalization time
Control (45)	3.15±0.48	2.74±0.49	7.63±0.34	23.38±4.29
Observation (45)	2.47±0.53	1.82±0.39	6.54±0.33	18.72±3.10
t	5.729	5.287	8.239	7.481
P	0.000	0.000	0.028	0.000

Table 2. Nutritional status

Group	Time	PAB (mg/L)	Alb (g/L)	TRF (g/L)
Control	Before	208.16±25.38	31.91±4.72	1.57±0.28
	After	236.86±28.44[a]	35.38±6.31[a]	2.01±0.40[a]
Observation	Before	210.74±24.93	32.56±4.88	1.50±0.26
	After	260.52±30.97[ab]	39.79±6.56[ab]	2.46±0.47[ab]

[a]$P<0.05$, a statistically significant difference compared to before treatment; [b]$P<0.05$, compared to the control group, the difference is statistically significant

Table 3 Occurrence of adverse reactions

Group	Ventosity	Abdominal pain	Nausea amd Vomiting	Total
Control (45)	3	2	3	8 (17.8)
Observation (45)	2	3	2	7 (15.6)
χ^2				0.080
P				0.77