Original Article
Food Science and Technology

ISSN 0101-2061 (Print)
ISSN 1678-457X (Online)

DOI: https://doi.org/10.1590/fst.109021

The influence of Nutren on postoperative nutritional status, inflammation and incision healing in patients with colon cancer

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Abstract

To explore the impact of Nutren on postoperative nutritional status, incision healing and inflammation in patients with colon cancer (CC). Division of 94 patients with CC as the research object was into the observation group (51 cases) and the control (43 cases) on the grounds of postoperative enteral nutrition support (ENS). Analysis of the influence of Nutren on postoperative nutritional status, inflammation and incision healing was performed. No distinct differences between the two groups in surgical efficacy, survival rate, distant metastasis rate and recurrence rate after surgery of 2 years ($P > 0.05$); The incision healing time of the observation was shorter versus the control, and the incision healing was superior versus the control. Hemoglobin, albumin and total plasma protein of 14 d after operation were elevated versus the control, and c-reactive protein (CRP), tumor necrosis factor-α (TNF-α), and interleukin (IL)-6 were declined versus the control ($P < 0.05$). Giving of enteral nutrition support is to patients after CC radical resection, which is available to ameliorate the nutritional status, accelerate incision healing, and decline inflammation.

Keywords: colon cancer; Nutren; postoperative; nutritional status; incision healing; inflammation.

Practical Application: Postoperative wound healing of colon cancer patients is nearly associated with the nutritional status of the body. Rational nutritional therapy can enhance postoperative resistance of colon cancer patients, decline the occurrence of complications to a certain extent, and boost disease recovery. Nutren is prevalently adopted in postoperative enteral nutrition therapy (ENT) for multiple diseases for its effectiveness of ameliorating the unbalanced intestinal flora in patients, protect the intestinal mucosal barrier, thus boosting the recovery of gastrointestinal function. We found that Nutren was available to mitigate and ameliorate the patient's statusthe inflammatory of CC patients after surgery, which may provided a new nutritional support method to alleviate the phenomenon of poor nutrition and prevent intestinal barrier function damage in the body to a certain extent.

1 Introduction

Colon cancer (CC) is a malignant tumor emanating from the colonic mucosa epithelium. Patients frequently present with symptoms like hematochezia and abdominal pain. Laparoscopic radical resection of CC, the crucial method for the treatment of CC, is available to remove the lesion and mitigate the impact of the lesion on the body. Nevertheless, this invasive treatment method inevitably leads to damage to the body and influence the integrity of intestinal mucosa (Bakker et al., 2020). Clinically, CC, as a popular malignant tumor of the digestive system, competes with normal cells for nutrition until intestinal mucosal cells become cancerous, leading to body malnutrition in patients. Additionally, intraoperative bleeding and perioperative fasting also result in nutrient loss and insufficient intake of patients, ultimately impacting postoperative recovery (Gačić et al., 2017; Hoshino et al., 2017). As reported, enteral nutrition therapy (ENT) for postoperative CC patients is available to ameliorate the patient's status (Hong et al., 2020). Enteral nutrition support (ENS) refers to the nutritional support method that offers nutrients and other nutrients needed for metabolism via the gastrointestinal tract, being able to alleviate the phenomenon of poor nutrition in the body to a certain extent. Some scholars state that timely supplementation of glutamine (Gln) is available to effectively prevent intestinal barrier function damage (Svetikiene et al., 2021). Nutren, an enteral nutrition powder, primarily composed of indispensable amino acids involving Gln and arginine, as well as other nutrients like vitamins and minerals, which is prevalently adopted in postoperative ENS for multiple diseases, but its application value in ENT of CC after surgery was continuously in the exploratory stage. Consequently, this study was to explore the influence of Nutren on postoperative nutritional status, inflammation and incision healing in CC patients, and references for the formulation of postoperative treatment methods for patients was offered.

2 Materials and methods

2.1 Clinical data

From January 2016 to September 2019, selection of Strategic Support Force Medical Center 94 CC patients was as the research object, Written informed consent was obtained from all participants and the present study was approved by the

Received 13 Oct., 2021
Accepted 27 Dec., 2021
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Institutional Review Board of Strategic Support Force Medical Center, and division was into the observation group according to the use of enteral nutrition after operation (adopting Nutren for ENS, 51 cases) and the control (No ENT, 43 cases) in line with the adoption of enteral nutrition (EN) after operation, no distinct differences in general data between the two groups ($P > 0.05$), as proved in Table 1.

2.2 Inclusion criteria

(1) In line with Chinese Guidelines for Diagnosis and Treatment of Colorectal Cancer (2015 Edition) (National Health and Family Planning Commission Medical Administration, 2015) about the diagnostic criteria of CC; (2) Patients with radical CC treatment; (3) Patients with complete clinical data; (4) 18 years old or less.

2.3 Exclusion criteria

(1) Patients with severe liver and kidney dysfunction; (2) Patients with severe metabolic disease; (3) Patients who underwent hormone, immunotherapy, radiotherapy and chemotherapy in the past six months; (4) Critically ill patients; (5) Patients with contraindications to EN therapy (6) Patients who were allergic to Nutren; (7) Patients with systemic infectious diseases prior to surgery.

2.4 Methods

Patients between the two, were given 30 kcal/kg non-protein energy, 1.25 g/kg protein and a thermo-nitrogen ratio of 150 kcal per day in line with their body weight with selective surgery. Selection of glucose, fat emulsion and amino acid injection, etc. was for thoracic venous nutrition support, and mixture of all preparations was in a 3 L bag prior to infusion.

Giving of ENS treatment was in the observation on this basis, and supply of Nutren (Nestle Suisse SA-Fabrik Konolfingen Factory, batch number: H20050239) was via a nasogastric tube, once a day. Each 100 g Nutren was available to offer 1927 kJ of energy, involving 17.5 g fat, 18.4 g protein, 58.2 g carbohydrate, and appropriate amount of minerals and vitamins.

2.5 Efficacy criteria

Time of tumor disappearance and maintenance over 4 weeks is complete remission; Tumor shrinkage of 25% and maintenance time over 4 weeks are partial remission; Tumor shrinkage of less than 25% to elevation of less than 25% and maintenance time over 4 weeks are stable; Progression is manifested elevation of 25% in tumor growth or the presence of new lesions. Total remission rate = complete remission rate + partial remission rate (Yang & Wu, 2004).

2.6 Observation indexes

(1) Postoperative correlated indexes: Comparison of the first postoperative exhaust time, first defecation time and postoperative hospital stay was performed between the two. (2) Nutritional status: Comparison of the body weights between the two was conducted 1 d prior to the operation and 14 d after the operation; Collection of 3 mL fasting venous blood was performed 1 d before the operation and 14 d after the operation. Determination of the plasma total protein, hemoglobin and

Table 1. Comparison of general data of patients between the two.

Groups	The observation (n = 51)	The control (n = 43)	$\chi^2/t/Z$	P
Gender (Male)	31	22	0.682	0.409
Age	57.16 ± 5.37	58.34 ± 5.62	1.039	0.302
Course (Months)	7.13 ± 1.19	7.20 ± 1.06	0.299	0.766
BMI(kg/m^2)	21.35 ± 2.68	21.17 ± 2.35	0.343	0.732
Operation time(min)	139.07 ± 5.42	141.29 ± 5.61	1.947	0.055
Intraoperative blood loss (mL)	89.34 ± 5.91	87.21 ± 6.05	1.722	0.088
Incision length (cm)	6.83 ± 1.16	6.98 ± 1.31	0.589	0.558
Tumor site				
Ascending colon	18	13	0.529	0.912
Transverse colon	7	8		
Descending colon	13	11		
Sigmoid colon	13	11		
Duck in installment				
B period	12	10	1.006	0.800
C1 period	15	16		
C2 period	15	12		
D period	9	5		
Tumor type				
Tubular adenocarcinoma	23	19	0.463	0.977
Papillary adenocarcinoma	13	10		
Mucinous adenocarcinoma	7	6		
Undifferentiated carcinoma	6	5		
Adenosquamous carcinoma	2	3		

albumin was performed. The kit was offered (Shenzhen Jingmei Biology, Shenzhen, China). (3) Incision healing: Comparison of the healing time and healing status were conducted between the two. Healing situation: Grade A healing: The incision healing was benign without inflammatory reactions like redness, swelling and induration; Grade B healing: The incision healing was poor, or accompanied via partial incision dehiscence and incision fat liquefaction, but the secretion culture results were aseptic growth; Grade C healing: The incision was purulent and split, and culture of incision excretion was with bacteria. (4) Inflammatory factors: Collection of 3 mL fasting venous blood was 1 d before and 14 d after the operation, and separation of the serum was behind centrifugation. Examination of the patient's C-reactive protein (CRP) and interleukin-6 (IL-6) was performed, and the kit was provided (Shanghai Kanglang Biotechnology Co., Ltd., Shanghai, China); Detection of the tumor necrosis factor-α (TNF-α) in patients was conducted, and the kit was provided (Shenzhen Jingmei Biology, Shenzhen, China). (5) Prognosis: Follow-up of the patients was for survival, tumor recurrence and distant metastasis for 2 years after surgery via telephone and outpatient. The follow-up time was 3 months, 6 months, 1 year, and 2 years after surgery, and the follow-up period was up to in September 2021 or the patient's date of death. (6) Complications: Record of the incidence of complications like incision infection and anastomotic leakage was performed 1 d before discharge.

2.7 Statistical processing

Processing of the data was with SPSS22.0 software, and representation of the enumeration data was as %. Comparison of the differences between groups was via adopting χ^2 test; Representation of the measurement data was as ($\bar{x}\pm s$), and comparison the differences between groups was adopting *t* test; Comparison of the differences between groups was via exerting Z test; Adoption of GraphPad Prism 5 was to plot survival curves, and comparison of the survival rate between groups was via adopting log-rankχ^2 test. $P < 0.05$ was accepted as indicative of significant differences.

3 Results

3.1 Comparison of surgical efficacy between the two

No distinct differences were in the comparison of tumor remission rates between the two ($P > 0.05$), as proved in Table 2.

3.2 Comparison of postoperative associated indexes between the two

No distinctive differences were in the first postoperative exhaust time **between the two** ($P > 0.05$); The first postoperative defecation time and postoperative hospitalization in the observation were shorter versus the control ($P < 0.05$), as presented in Figure 1.

3.3 Comparison of nutritional status between the two before and after surgery

No distinct differences were in the weight and hemoglobin, albumin, and total plasma protein between the two 1 d prior to surgery ($P > 0.05$); The weight in the observation was elevated versus the control 14 d after surgery, and albumin, hemoglobin and plasma total protein were augmented versus the control ($P < 0.05$), as proved in Figure 2.

3.4 Comparison of incision healing and healing between the two

Incision healing time in the observation was (8.31 ± 1.32) d, which was shorter versus (9.82 ± 1.79) d of the control ($P < 0.05$), as presented in Figure 3; The incision healing in the observation was superior versus the control ($P < 0.05$), as proved in Table 3.

3.5 Comparison of the inflammation between the two before and after surgery

No distinct differences were in CRP, IL-6 and TNF-α between the two 1 d prior to surgery ($P > 0.05$); CRP, IL-6 and TNF-α 14 d after surgery in the observation was declined versus the control ($P < 0.05$), as proved in Figure 4.

Table 2. Comparison of surgical efficacy between the two (cases, %).

Groups	n	Complete response	Partial response	Stabilization	Progression	Overall response rate
The observation	51	29	11	9	2	78.43 (40)
The control	43	21	12	8	2	76.74 (33)
χ^2						0.038
P						0.845

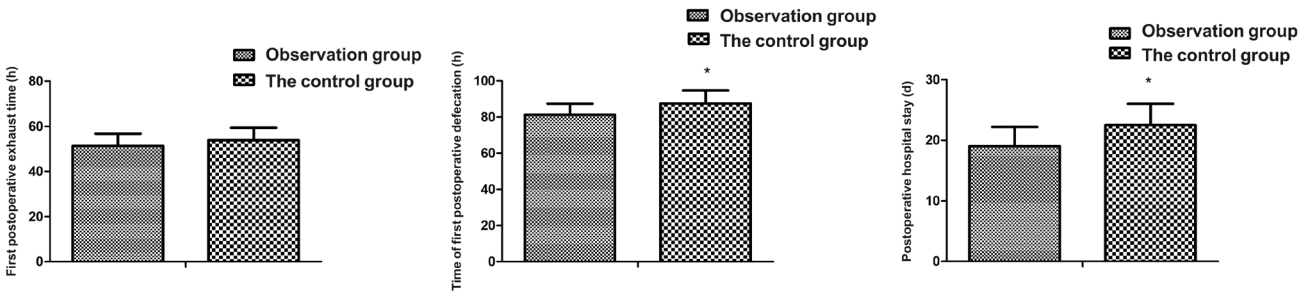

Figure 1. Comparison of postoperative associated indexes between the two. (*$P < 0.05$ versus the observation).

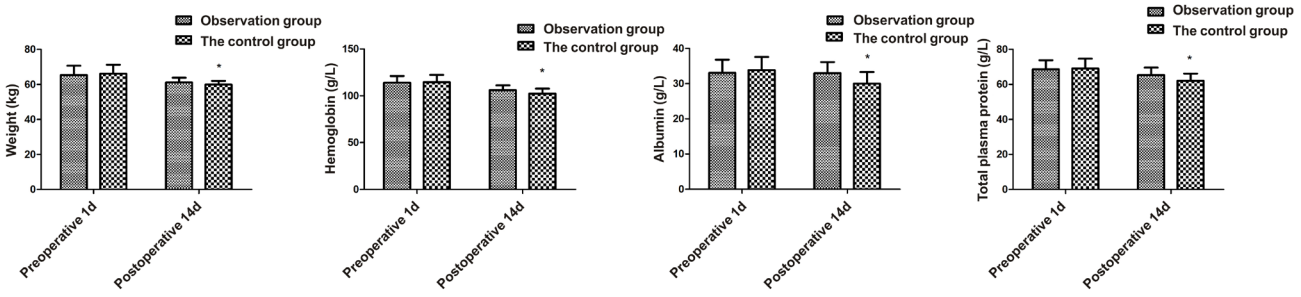

Figure 2. Comparison of nutritional status between the two before and after treatment. (*$P < 0.05$ versus the observation).

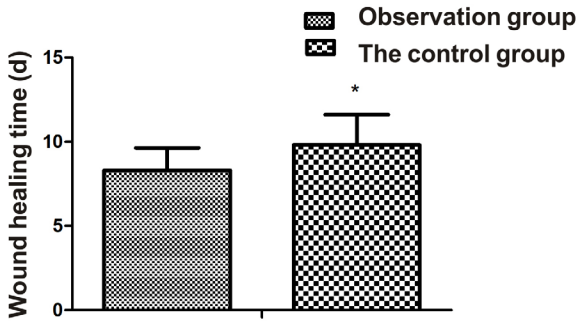

Figure 3. Comparison of incision healing time between the two. (*$P < 0.05$ versus the observation).

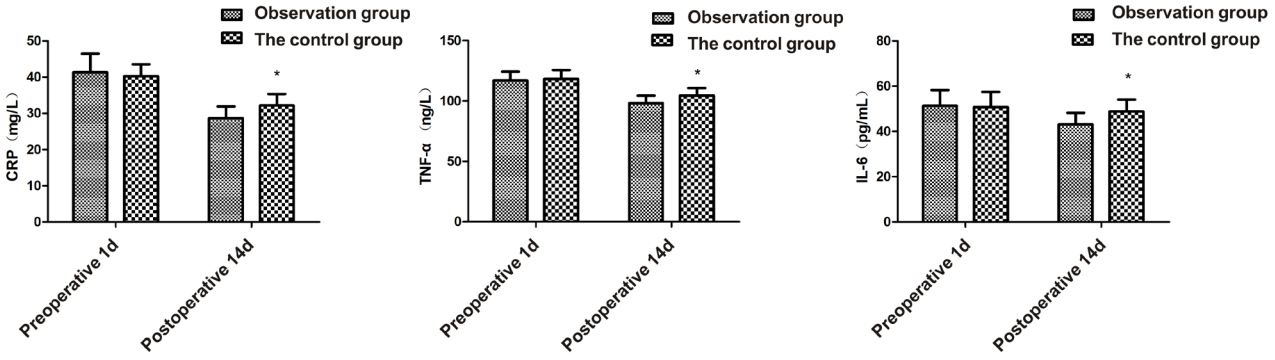

Figure 4. Comparison of inflammation between the two before and after operation. (*$P < 0.05$ versus the observation).

Table 3. Comparison of incision healing between the two before and after treatment (cases).

Groups	n	Class A	Class B	Class C
The observation	51	45	6	0
The control	43	31	9	3
Z			4.263	
P			0.039	

Table 4. Comparison of prognosis between the two (cases, %).

Groups	n	Survival rate	Recurrence rate	Distant metastasis rate
The observation	51	86.27 (44)	5.88 (3)	3.92 (2)
The control	43	79.07 (34)	9.30 (4)	4.65 (2)
Log-rank χ^2/χ^2		0.853	0.055	0.114
P		0.356	0.814	0.735

3.6 Comparison of the prognosis between the two

No distinct differences were in the survival rate, recurrence rate and distant metastasis rate between the two after surgery of 2 years ($P > 0.05$), as presented in Table 4 and Figure 5.

3.7 Comparison of the incidence of postoperative complications between the two

The total incidence of postoperative complications in the observation was declined versus the control ($P < 0.05$), as presented in Table 5.

4 Discussion

CC is a gastrointestinal tumor (GIST) in the colon, mostly occurring at the junction of the rectum and the sigmoid colon with the incidence of GIST ranking third among GIST. Patients

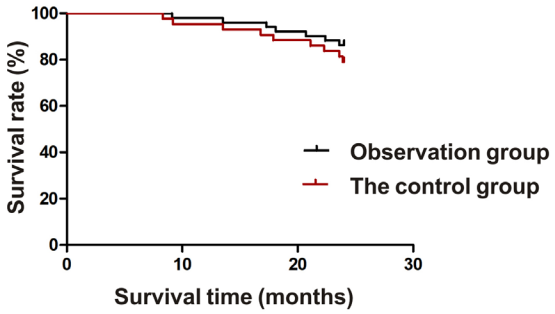

Figure 5. Analysis of survival curves between the two.

Table 5. Comparison of the incidence of postoperative complications between the two.

Groups	n	Infection of incisional wound	Anastomotic fistula	Incision fat liquefaction	Urinary retention	Total incidence
The observation	51	0	0	1	1	3.92 (2)
The control	43	1	1	3	2	16.28 (7)
χ^2						4.115
P						0.043

frequently were not provided with distinct symptoms at an early stage, but some symptoms like dyspepsia and abdominal distension are presented until the disease is in middle and late stages (Kang et al., 2019). Relevant studies have been clarified that rational nutritional therapy is available to strengthen the body's resistance to disease, decline the occurrence of postoperative complications to a certain extent, and boost disease recovery (Li et al., 2009; Holmén et al., 2021). In this study, the incidence of postoperative complications in the observation is distinctively elevated versus the control, manifesting that postoperative ENT with Nutren is able to decline the incidence of complications. This might be associated with the fact that essential amino acids like Gln and arginine and other nutrients in Nutren are available to ameliorate the nutritional status of the body (Svetikiene et al., 2021). Nevertheless, the results have manifested that no distinct differences were in surgical efficacy between the two, clarifying that postoperative enteral nutrition exerts little influence on the therapeutic effect of CC radical resection, which is inconsistent with the results of foregoing studies (Xu et al., 2020). It is primarily associated with the limited sample size of this study, so the sample size should be aggrandized later for further analysis.

CC patients before and after surgery should restrict their diet, being able to lead to iatrogenic malnutrition. Gln is a crucial source of protein synthesis in the body. Relevant reports have manifested that deficient or deficient Gln extremely tends to occur in intravenous nutrition or essential diet (Tominaga et al., 2020). Some scholars maintain that total intravenous infusion without Gln is available to atrophy small intestine villi, weaken the intestinal immune function, thin the intestinal wall or impact the intestinal barrier and absorption function (Wan et al., 2020). Patients need to fast and drink after surgery, and the intestine is in a solution state. The lack of food and stimulation of gastrointestinal hormone are in the intestinal mucosa, which renders the intestinal villi to atrophy and the intestinal mucosa to become thinner to lead to the declined support capacity of the intestinal mucosa and the attenuate intestinal barrier function, thus impacting the intestinal digestion and absorption to lead to nutrient absorption disorders in the later stage (Hu et al., 2017). Relevant studies have clarified that ENT for postoperative CC patients is available to accelerate the absorption of nutrients, thereby enhancing the nutritional status of the body (Cheng et al., 2018; Zeng et al., 2017). Nutren was composed of casein and whey protein with elevated nutrition and easy digestion with abundant multiple indispensable amino acids, vitamins and minerals, which was a comprehensive and balanced enteral nutritious diet with easy digestion and absorption, and elevated utilization rate and no lactose, and was able to avoid diarrhea caused via lactose intolerance without dietary fiber and food residues in the intestine after eating, meanwhile, it was able to cleanse the intestine. This study clarified that the weight in the observation was elevated versus the control 14 d after surgery, and hemoglobin, albumin, and total plasma protein were augmented versus the control. It manifests that ENS was given to patients with CC after radical operation being able to ameliorate the nutritional status of the body, which is primarily associated with the abundance of multiple nutrients in Nutren (Lin et al., 2021). The results clarified that the first defecation time and postoperative hospitalization in the observation were shorter versus the control, elucidating that postoperative enteral nutrition was able to boost the recovery of gastrointestinal function in patients after CC surgery. The critical reason was that Nutren was available to ameliorate the unbalanced intestinal flora in patients, protect the intestinal mucosal barrier, thus boosting the recovery of gastrointestinal function.

Presently, incision healing is also nearly associated with the nutritional status of the body. Poor nutrition is available to lead to substances like synthesis barriers of protein and nucleotide, and impact cell advancement, ultimately delaying incision healing and elevating the risk of incision infections (Yu et al., 2020; Liu et al., 2019). Consequently, the author maintains that incision healing

is available to be accelerated via ameliorating the nutritional status of the body. In this study, the incision healing time in the observation was shorter versus the control, and the incision healing was elevated versus the control, manifesting that ENS of Nutren in patients after CC radical resection being available to accelerate incision healing. It is consistent with the results of relevant studies (Tao et al., 2018), which above conjecture is further verified. The destruction of the intestinal mucosal barrier is able to lead to translocation of intestinal flora, cause intestinal infections, and elevated the secretion of inflammatory factors (Lee et al., 2020; Xu et al., 2016). The results clarified that CRP, TNF-α, and IL-6 in the observation were declined versus the control 14 d after surgery, manifesting that Nutren was available to mitigate the inflammatory of CC patients after surgery. The Gln and arginine are able to boost the body's protein synthesis and nitrogen balance, maintain the integrity of the intestinal mucosa, and prevent bacterial translocation. Additionally, no distinct differences are in the survival rate, recurrence rate, and distant metastasis rate between the two after surgery of 2 years, manifesting that ENT for CC patients after surgery does not impact the prognosis (Xueting et al., 2021; Cao et al., 2021). It is primarily associated with few patients covered in this study, so the sample size should be elevated to further analyze the impact of the treatment on the prognosis of patients.

To sum up, ENS of Nutren after CC radical resection was available to ameliorate nutritional status, boost incision healing, and decline inflammation, but little influence was on the prognosis of patients.

Conflict of interest

The authors declare that they have no competing interests.

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