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Original Article

The application of the county medical community HCH model in postoperative nutrition management for patients with advanced gastrointestinal carcinoma

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Abstract: Objective: To investigate the application effect of the county medical community Hospital-Community health service organization-Home (HCH) model in nutritional management of patients with advanced gastrointestinal cancer after surgery. Methods: This is a retrospective study. A total of 100 postoperative malnutrition patients with advanced gastrointestinal malignant tumors admitted to Lanxi People's Hospital from January 2022 to August 2022 were selected as subjects. All patients were divided into an observation group (n=50) or control group (n=50) according to the different methods of intervention. Patients in the observation group underwent care according to our county medical community HCH model, while those in the control group received routine perioperative nutrition management. The nutritional risk screening scores (NRS2002), Patient-Generated Subjective Global Assessment (PG-SGA) scores, body mass index (BMI), triceps skinfold thickness (TSF), upper arm circumference (AC); a well as levels of serum albumin (ALB), prealbumin (PA), transferrin (TRF), retinol binding protein (RBP), creatinine (Cr) and Free fatty acid (FFA); levels of immunoglobulin G (IgG), immunoglobulin M (IgM) and immunoglobulin A (IgA); and the levels of sodium (Na^+), potassium (K^+), calcium (Ca^+) and lactic acid, and quality of life were recorded and compared between two groups. Results: Compared with those before intervention, NRS2002 scores, PG-SGA score, BMI, TSF and AC after intervention were significantly improved in both groups. Compared with those after intervention in the control group, the NRS2002 score, PG-SGA score, BMI, TSF and AC of the patients in the observation group were significantly improved (all $P<0.001$). Compared with those before intervention, the levels of ALB, PA, TRF, RBP, Cr, FFA, IgG, IgM and IgA in the two groups were significantly higher after intervention. The levels of ALB, PA, TRF, RBP, Cr, FFA, IgG, IgM and IgA after intervention in the observation group were significantly higher than those in the control group (all $P<0.05$). Compared with those before management, the levels of Na^+, K^+ and lactic acid in the two groups were significantly decreased and the level of Ca^+ was significantly increased after intervention. Compared with those after intervention in the control group, the patients in the observation group had significantly lower levels of Na^+, K^+ and lactic acid, and higher levels of Ca^+ (all $P<0.05$). Compared with those before intervention, the scores of mental status, appetite, sleep quality, daily life and family understanding and cooperation in patients from the two groups after intervention were significantly higher. Compared with those after intervention in the control group, the patients in the observation group had significantly higher scores of life quality ($P<0.05$). Conclusion: The county medical community HCH model has a good effect in the nutritional management of patients with advanced gastrointestinal cancer surgery. The HCH model can effectively improve the nutritional status, enhance the immune function, and increase the quality of life. Thus it is worthy of clinical application.

Keywords: Gastrointestinal cancer, county medical community, nutritional management, hospital-community health service organization-home

Introduction

Patients with malignant gastrointestinal tumors have metabolic disorders such as abnormal carbohydrate metabolism, increased protein conversion rate, increased fat decomposition, decreased storage, muscle and visceral protein consumption, weight loss, and imbalance of water and electrolytes [1]. In particular, patients with advanced tumors have nutrient digestion

and absorption disorders caused by eating disorders, delayed emptying, gastrointestinal obstruction, gastrointestinal reconstruction and other factors; all this combined with surgery, anorexia and early satiety caused by pain, nausea and vomiting, anxiety and depression during radiotherapy and chemotherapy and other anti-tumor treatments seriously affects the nutrient intake of patients, leading to malnutrition, affecting the prognosis [2, 3]. As nutrition problems accompany patients with gastrointestinal cancer, individualized nutrition therapy for hospitalized patients with gastrointestinal cancer with nutritional risks and malnutrition can improve the nutritional status of patients, regulate tumor cell metabolism, improve tumor treatment sensitivity and compliance, and reduce the incidence of complications [4, 5]. The general hospital community family (HCH) model of our county medical community is a nursing method that takes nutritional status as the basic vital sign, into routine examination. It can effectively improve the nutritional diagnosis rate and nutritional treatment rate, improve the nutritional management status of tumor patients in grass-roots hospitals, so as to improve the effect of tumor treatment, reduce the readmission rate, improve the quality of life of patients, prolong the survival time of patients, and save medical expenses [6]. In order to further explore the effect of its application in improving the nutritional status of tumor patients, this study investigated 100 patients with malnutrition after operation for advanced gastrointestinal cancer. The results of this study provide clinical evidence for nutritional management of these patients.

Materials and methods

General information

In this retrospective study, 100 patients with malnutrition following advanced gastrointestinal carcinoma surgery at Lanxi People's Hospital from January 2022 to August 2022 were enrolled. These patients were divided into two groups according to different methods of nutrition management. Inclusion criteria: ① Patients aged over 18 years old. ② The scores of nutrition risk screening version 2002 (NRS2002) were more than three points. ③ The scores of Patient-Generated Subjective Global Assessment were above B level [7]. ④ Advanced gastrointestinal carcinoma was confirmed by pathological and imaging examination. ⑤ All the patients underwent radical surgery for gastrointestinal tumor. ⑥ Patients were not accompanied with cognitive impairment or language communication disorders.

Exclusion criteria: ① Postoperative severe complications such as anastomotic leakage above grade B occurred. ② Patients suffered from dysfunction of heart, lung, liver and kidney. ③ Pediatric patients were with incomplete medical records. ④ Patients were unable to cooperate with this research.

For the control group, 50 patients received routine perioperative nutritional intervention. For the observation group, 50 patients were treated with the county medical community HCH model. This study was approved by the Ethics Committee of Lanxi People's Hospital (Approval No. 2021-028).

Methods

Routine perioperative nutritional intervention was conducted in the control group. The details were as follows: Routine nutrition risk screening and assessment were performed for patients admitted into the hospital, and routine nutrition treatment strategies were conducted. ① When patients were not eating enough orally, oral nutrition supplement was supplemented. When the digestive tract function was basically normal and the intake was insufficient due to eating disorders and other reasons, a tube feeding was provided. ② The enteral nutrition combined with parenteral nutrition was performed when the requirements for nutrients could not be met through oral feeding and enteral nutrition. When the enteral nutrition was not feasible or intolerable, total parenteral nutrition was given. ③ Discharged patients were informed to return to the hospital for further consultation in case of loss of food intake, weight loss, etc. Oral or telephone education and follow-up were conducted for the patients and their families.

The county medical community HCH model was conducted in the observation group. Implemented standardized nutrition management and follow-up intervention were implemented. The details were as follows: ① The nutritional management team using the county

medical community HCH model for postoperative patients with gastrointestinal malignant tumors was established. Members from medical community hospitals include 8 clinicians, 2 clinical nutritionists, 16 nurses in the ward, 2 tumor case managers, 16 doctors and 16 nurses in the community health service center. The 16 community health service institutions in the medical community were contacted to achieve full coverage in the county. All medical personnel underwent trainings such as standardized nutrition assessment and intervention plans, and passed the examination. ② Patient nutrition management files were established in the medical community information platform. The treatment of patients in the observation group during hospitalization was the same as that of the control group. The three-step nutritional treatment strategy was implemented: the multi-disciplinary team (MDT) group discussion was organized in time when nutritional risks and malnutrition were found in patients. The concept of accelerated rehabilitation surgery was implemented and the perioperative nutritional intervention were individualized. Patients who planned to implement adjuvant radiotherapy and chemotherapy after surgery were given nutritional treatment mainly with oral nutrients such as Enteral Nutritional Emulsion, Ensure Nutrison, whey protein powder, etc. In order to achieve the target energy requirement of 20-30 Kcal/(Kg/d), daily water intake of 30-40 ml/(Kg/d), protein intake of 1.5-2 g (Kg/d), nutritional therapy lasted for 6 months or more. Nurses in the ward provided nutrition guidance and diet education to patients and their families, and transmitted patient information and nutrition prescriptions to the community health service center. ③ Patients and their families were given nutrition knowledge training after admission. They were informed of their personal energy requirements and learned to use simple diet self-assessment tools. The type of food during daily food intake, the conditions of stool and urine and so on were recorded. The mode and duration of daily aerobic exercise or resistance exercise were also recorded. ④ A WeChat group was established. It was managed by the tumor case manager, who was responsible for providing consultation and guidance for patients and their families, regularly giving health education materials, etc. The official account of the medical community provided the inquiry of inspection results, appointment registration, etc.

Observed indicators

The primary indicators included nutritional scores and human measurement indexes, and the secondary ones included liver and kidney function, immune function, the levels of electrolyte and lactic acid and the quality of life.

(1) Nutritional score was compared between two groups. The nutrition risk screening scoring scale (NRS2002) [8] and Patient-Generated Subjective Global Assessment (PG-SGA) scale [9] were used for evaluation. Among them, malnutrition indicated that the total score of NRS2002 was more than 3 points. Potential malnutrition suggested that the total score of NRS2002 was between 1 and 2 points. Zero indicated the normal nutrition. In term of PG-SGA scale, grade A indicated good nutrition, grade B indicated mild malnutrition and grade C suggested severe malnutrition.

(2) Human measurement index was compared between the two groups. Before intervention and at 3 months after intervention, the triceps skinfold thickness (TSF) and upper arm circumference (AC) were measured. Body mass index (BMI) was also calculated.

(3) Liver and kidney function were compared between two groups. Before intervention and at 3 months after intervention, 10 ml of fasting blood from the morning was drawn from the peripheral venins of patients, and then the supernatant was aquired through centrifugation (time: 15 min, rotational speed: 3500 r/min) for examination. The levels of serum albumin (ALB) were detected by the bromocresol green endpoint method. The levels of prealbumin (PA) were detected by the immunoturbidimetry methods. The levels of transferrin (TRF) and retinol binding protein (RBP) were detected by the rate nephelometry. The levels of creatinine (Cr) and free fatty acid (FFA) were measured by the enzyme method.

(4) Immune function was compared between the two groups. The supernatant was obtained as above. Before intervention and 3 months after intervention, the levels of immunoglobulin G (IgG), immunoglobulin M (IgM) and immuno-

Table 1. Comparison of general information between the two groups

Group	Control group (n=50)	Observation group (n=50)	t/χ^2 value	*P* value
Age (years)	57.39±1.51	57.37±1.47	0.106	0.924
Gender (n)			0.608	0.452
Male	27	29		
Female	23	21		
Course of disease (years)	3.16±0.59	3.15±0.58	0.110	0.907
Types of disease			1.105	0.591
Gastric cancer (n)	25	22		
Rectal cancer (n)	16	18		
Colon cancer (n)	9	10		

globulin A (IgA) were measured by the immune-suspension method.

(5) The levels of electrolyte and lactic acid were compared between the two groups. The supernatant was achieved as above. Before intervention and at 3 months after intervention, the levels of Na^+, K^+, Ca^+ and lactic acid were determined by spectrophotometry.

(6) The quality of life was compared between both groups. The self-rating scale of quality of life for cancer patients [10] was used for evaluation. The scale included five aspects: mental status, appetite status, sleep quality, conditions of daily life and family understanding and cooperation. A higher score indicated better quality of life.

Statistical analysis

The data included in this study were analyzed using SPSS statistical software version 23.0 (IBM, USA). The graphic software applied in this study was GraphPad Prism version 8.0 (GraphPad Software, Inc., La Jolla, CA, USA). The measurement data were described as Mean ± Standard Deviation (SD). t test was used for comparison between the groups. The counting data were described as number/percentage (n/%). Chi-square test was conducted for the comparison between two groups. P<0.05 indicated the significantly statistical difference.

Results

Comparison of general information

As shown in **Table 1**, there were no remarkable differences in the terms of age, gender, course of disease and types of disease between the two groups (all P>0.05).

Comparison of the nutritional scores between two groups

There was no statistical difference in NRS (version 2002) scores and PG-SGA scores before intervention between two groups. Compared with those before intervention, NRS (version 2002) scores and PG-SGA scores after intervention in both of groups were significantly improved (all P<0.001). Compared with those after intervention in the control group, NRS (version 2002) scores and PG-SGA scores after intervention in observation group were obviously improved (all P<0.001), as seen in **Table 2**.

Comparison of human measurement indices between the two groups

Before the intervention, there were no significant differences in the terms of BMI (15.18± 2.16 kg/m^2 vs 15.25±2.11 kg/m^2), TSF (5.38± 1.87 cm vs 5.44±1.85 cm) and AC (13.38± 2.05 cm vs 13.41±2.11 cm) between the two groups. After the intervention, the indexes of BMI, TSF and AC in both groups were significantly improved (all P<0.001), and these indices in the observation group were significantly higher than those in control group, as shown in **Table 3**.

Comparison of liver and kidney function between the two groups

As seen in **Table 4**, before the intervention, there were no significant differences in the levels of ALB, PA, TRF, RBP, Cr and FFA. After the intervention, the levels of ALB, PA, TRF, RBP, Cr

Table 2. Comparison of NRS (version 2002) scores and PG-SGA scores between the two groups

Parameters		Observation group (n=50)		χ^2 value	*P* value	Control group (n=50)		χ^2 value	*P* value
		Before intervention	After intervention			Before intervention	After intervention		
NRS (version 2002) scores	Normal nutrition	0 (0.00)	42 (84.00)			0 (0.00)	29 (58.00)		
	Potential malnutrition	0 (0.00)	5 (10.00)	15.263	<0.001	0 (0.00)	11 (22.00)	12.360	<0.001
	Malnutrition	50 (100.00)	3 (6.00)			50 (100.00)	10 (20.00)		
PG-SGA scores	Grade A	0 (0.00)	43 (86.00)			0 (0.00)	18 (36.00)		
	Grade B	39 (78.00)	5 (10.00)	16.916	<0.001	37 (74.00)	27 (54.00)	21.951	<0.001
	Grade C	11 (22.00)	2 (4.00)			13 (26.00)	5 (10.00)		

Note: NRS: Nutrition Risk Screening; PG-SGA: Patient-Generated Subjective Global Assessment.

Table 3. Comparison of human measurement index between the two groups

		Observation group (n=50)	Control group (n=50)	t value	*P* value
BMI (kg/m^2)	Before intervention	15.18±2.16	15.25±2.11	0.164	0.870
	After intervention	25.21±5.24	20.42±3.63	5.313	<0.001
TSF (cm)	Before intervention	5.38±1.87	5.44±1.85	0.161	0.872
	After intervention	14.28±4.55	9.66±3.19	5.879	<0.001
AC (cm)	Before intervention	13.38±2.05	13.41±2.11	0.072	0.943
	After intervention	23.39±2.64	18.97±3.85	6.695	<0.001

Note: BMI: Body Mass Index; TSF: Triceps Skinfold Thickness; AC: Arm Circumference.

Table 4. Comparison of liver and kidney function between the two groups

		Observation group (n=50)	Control group (n=50)	t value	*P* value
ALB (g/L)	Before intervention	15.18±2.16	15.25±2.11	0.164	0.870
	After intervention	25.21±5.24	20.42±3.63	5.313	<0.001
PA (mg/L)	Before intervention	5.38±1.87	5.44±1.85	0.161	0.872
	After intervention	14.28±4.55	9.66±3.19	5.879	<0.001
TRF (g/L)	Before intervention	13.38±2.05	13.41±2.11	0.072	0.943
	After intervention	23.39±2.64	18.97±3.85	6.695	<0.001
RBP (mg/L)	Before intervention	28.31±8.69	28.33±8.67	0.012	0.991
	After intervention	37.71±8.74	33.59±8.71	2.361	0.020
Cr (μmol/L)	Before intervention	50.16±2.45	50.31±2.21	0.322	0.749
	After intervention	68.15±17.26	60.38±14.22	2.457	0.016
FFA (mmol/L)	Before intervention	0.25±0.04	0.24±0.03	1.414	0.161
	After intervention	0.62±0.06	0.41±0.05	19.013	<0.001

Note: ALB: Albumin; PA: Prealbumin; TRF: Transferrin; RBP: Retinol binding protein; Cr: Creatinine; FFA: Free fatty acid.

Table 5. Comparison of the immune function between both groups ($\bar{x} \pm s$, g/L)

		Observation group (n=50)	Control group (n=50)	t value	*P* value
IgG	Before intervention	7.39±0.52	7.40±0.54	0.094	0.925
	After intervention	8.64±0.72	8.31±0.58	2.524	0.013
IgM	Before intervention	0.87±0.04	0.86±0.05	1.104	0.272
	After intervention	1.51±0.07	1.27±0.08	15.965	<0.001
IgA	Before intervention	2.29±0.15	2.27±0.17	0.624	0.534
	After intervention	3.21±0.16	3.08±0.14	4.324	<0.001

Note: IgG: Immunoglobulin G; IgM: Immunoglobulin M; IgA: Immunoglobulin A.

Table 6. Comparison of the levels of electrolyte and lactic acid between both groups ($\bar{x} \pm s$, mmol/L)

		Observation group (n=50)	Control group (n=50)	t value	*P* value
Na^+	Before intervention	162.29±6.31	163.18±6.28	0.707	0.481
	After intervention	139.58±4.50	146.37±5.17	7.005	<0.001
K^+	Before intervention	4.38±0.57	4.41±0.56	0.266	0.791
	After intervention	3.78±0.39	3.98±0.41	2.499	0.014
Ca^+	Before intervention	1.73±0.24	1.74±0.26	0.200	0.842
	After intervention	2.12±0.46	1.87±0.32	3.155	0.002
Lactic acid	Before intervention	1.94±0.94	1.95±0.96	0.053	0.958
	After intervention	1.13±0.83	1.55±0.92	2.397	0.018

and FFA in both groups were significantly increased (all P<0.001), and these levels in in the observation group were significantly higher than those in the control group (all P<0.001).

Comparison of the immune function between two groups

There were no statistical differences for the levels of IgG, IgM and IgA before intervention between both groups. After the intervention, the levels of IgG, IgM and IgA improved significantly in both of groups, and the observation group exerted significantly higher levels of IgG, IgM and IgA than those in control group (all P<0.001), as seen in **Table 5**.

Comparison of the levels of electrolyte and lactic acid between two groups

As seen in **Table 6**, before the intervention, there were no significant differences in the levels of electrolytes and lactic acid. After the intervention, the levels of Na^+, K^+ and lactic acid

Table 7. Comparison of the scores of life quality between both groups

		Observation group (n=50)	Control group (n=50)	t value	*P* value
Mental status	Before intervention	2.88±0.39	2.89±0.38	0.130	0.897
	After intervention	3.65±0.32	3.21±0.28	7.317	<0.001
Appetite status	Before intervention	2.59±0.11	2.58±0.12	0.434	0.665
	After intervention	3.12±0.34	2.86±0.31	3.996	<0.001
Sleep quality	Before intervention	3.66±0.49	3.63±0.47	0.312	0.755
	After intervention	4.24±0.59	3.99±0.43	2.421	0.017
Conditions of daily life	Before intervention	3.02±0.37	3.01±0.35	0.139	0.890
	After intervention	4.02±0.44	3.79±0.42	2.674	0.009
Family understanding and cooperation	Before intervention	2.75±0.49	2.74±0.47	0.104	0.917
	After intervention	3.54±0.46	3.06±0.42	5.449	<0.001

in both groups were significantly decreased, while the level of Ca^{+} was obviously increased (all P<0.05), and the decrease/increase was more obvious in the observation group than those in the control group (all P<0.05).

Comparison of the life quality between two groups

Before the intervention, there was no significant difference in life quality between two groups. After intervention, in the observation group, the scores for mental status, appetite status, sleep quality, conditions of daily life and family understanding and cooperation were 3.65±0.32, 3.12±0.34, 4.24±0.59, 4.02±0.44, and 3.54±0.46, respectively; while those in the control group were 3.21±0.28, 2.86±0.31, 3.99±0.43, 3.79±0.42, and 3.06±0.42, respectively (all P<0.05), as seen in **Table 7**.

Discussion

At present, perioperative nutritional support for gastrointestinal cancer patients has become the primary focus of experts both at home and abroad. However, the latest research results have shown that the overall incidence of malnutrition in cancer patients hospitalized in third-class a hospitals was as high as 80%, and the nutritional treatment rate for malnourished patients with tumors was only 34% [11]. In addition, there was insufficient management in patients after discharge in the terms of nutritional status monitoring, dietary guidance, nutritional support and nursing. Moreover, postoperative radiotherapy and chemotherapy, and targeted therapy can seriously affected the nutritional status of patients [12]. Compared with the nutritional teams in the tertiary hospitals in the cities, most medical personnel in primary hospitals, especially in community medical institutions, have not received the training of standardized nutrition related knowledge. The nutrition knowledge and technology levels regarding cancer are not high, which leads to the lack of relevant nutrition management and guidance for patients after discharge, inadequate nutrition intake, accelerated nutrition risks and malnutrition incidences, and finally this affected treatment compliance and efficacy [13]. Therefore, it is of great significance in order to improve the prognosis of patients to find an effective intervention method to improve the nutritional status of patients after surgery.

The nutrition management of the hospital-community-family (HCH) model is a nutrition management model of the hierarchical management, three-level linkage, seamless connection and two-way circulating links, which was first proposed by the Cancer Nutrition and Support Therapy Professional Committee in the China Anti-Cancer Association. Some studies have revealed that through performing the experimental unit of county-township-village HCH nutritional management model, the nutritional level of patients had been effectively improved, and their subjective feelings and nutritional status had also been significantly enhanced [14, 15]. In this study, the results showed that through the application of the county medical community HCH management model in patients with malnutrition after the operation of advanced gastrointestinal tumors, the patients' indexes regarding nutritional scores, BMI, TSF and AC were significantly improved, suggesting that the dietary guidance in this management

model could help patients to alter their dietary habits, establish a healthy diet concept, develop a healthy diet structure and ultimately improve their nutritional status [16, 17]. At the same time, the results also showed that the levels of ALB, PA, TRF, RBP, Cr, FFA, IgG, IgM and IgA in the patients who underwent the county medical community HCH management model were significantly higher than those of the patients who were treated with routine perioperative nutrition management, indicating that the liver and kidney functions and immune functions were significantly improved. The reason may be that the improvement of nutritional status can improve the body's immunity, enhance the ability to eliminate risks, and reduce damage caused to the body by the surgery and subsequent radiotherapy and chemotherapy [18, 19], which ultimately lead to the improvement of the liver and kidney function and immune function in these patients.

In addition, the results showed that the electrolytes and lactic acid of patients were significantly improved after the implementation of the county medical community HCH model, suggesting that this intervention mode can effectively maintain the balance of electrolytes and lactic acid in patients and reduce the damage to the body due to nutritional problems. The results of this study also showed that after implementing the HCH management model of the county medical community, the quality of life of patients had been significantly improved, which may be due to the joint participation of the general hospital of the medical community, community health service institutions, as patients and their families build a whole process management mechanism for tumor patients in the hospital. In view of the high incidence of postoperative malnutrition and low nutritional treatment rate of patients with advanced gastrointestinal cancer, the diagnosis rate of malnutrition and nutrition risk was obviously increased through standardized nutrition management and regular nutrition evaluation, and the nutritional status of patients were improved and the needs of patients for nutrition services were met by implementing dietary guidance, oral nutrition support and other interventions and treatments [20, 21].

In conclusion, the county medical community HCH model has a good effect in the postoperative nutritional management in patients with advanced gastrointestinal cancer. It can effectively improve the nutritional status of patients, improve immune function, maintain electrolyte balance, and improve the quality of life. It is worthy of further promotion and application in clinical practice. However, our study also has several limitations, including a small sample size, being a single-center study, with short-term outcomes of HCH model nutritional management, a lack of long-term results and no subgroup comparison, etc. Therefore, there is a need to employ larger sample sizes of multicenter randomized controlled studies using long-term follow-up to find more precise conclusions.

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Disclosure of conflict of interest

None.

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