Establishment and application of home nutrition nursing and follow-up management pattern for patients with intestinal failure

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Running title: Home nutrition in patients with intestinal failure

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ABSTRACT

Background and Objectives: To establish and apply the home nutrition care and follow-up management pattern for the treatment of patients with intestinal failure (IF). **Methods and Study Design:** This retrospective study analyzed patients with IF who received nutrition nursing and follow-up management at the Clinical Nutrition Treatment Center of Jinling Hospital between January 2018 and April 2022. The changes in nutritional indicators and body compositions of patients before and after standardized management were recorded and compared. **Results:** A total of 65 patients with IF were enrolled, with a mean age of 52.4 ± 15.8 years and BMI of 17.9 ± 2.7 kg/m^2. Compared with before the application of home nutrition nursing and follow-up management, nutritional indicators (Albumin, Prealbumin, and Hemoglobin) were improved significantly in IF patients after the standard management (p<0.05, all). In addition, the body mass index (BMI), fat-free mass index (FFMI), and skeletal muscle mass index (SMI) were also significantly increased after standard management (p<0.05, all). **Conclusions:** The establishment and application of home nutrition nursing and follow-up pattern could ensure the nutritional support effect and improve the nutritional status and body composition of patients with IF.

Key Words: intestinal failure, home nutrition, body composition, Bioelectrical impedance analysis; Follow-up management pattern

INTRODUCTION

Intestinal failure is defined as the decline in intestinal function that does not meet the minimum requirements for macronutrient and/or water and electrolyte absorption according to the ESPEN-endorsed recommendation[1]. The prone to malnutrition makes nutrition supplementation and nursing necessary for patients with IF to maintain nutritional status and/or growth[2]. In addition, malnutrition and accompanying alterations in patient's body composition (BC) are not negligible[3], and a progressive loss of skeletal muscle mass and function (i.e. sarcopenia) may accrued[4]. Reasonable nutritional support and diet instruction could be formulated according to the specific classification of patients to promote intestinal rehabilitation and improve nutritional status[5,6]. Under the guidance of the professional nutrition support group, patients with relatively stable diseases could receive home nutritional (HN) support, which is divided into home parenteral nutrition and home enteral nutrition. In 2003, a clinician and multidisciplinary nutrition support team (NST) that had an interest and experience in IF was built up in Jinling hospital. Our medical team has helped many

malnourished patients with intestinal failure to improve nutritional status, BC, Phase angel (PhA),and quality of life (QoL)[7]. In addition, the trained nutritional nurses have also done a lot of work in educating patients and/or caregivers on home nutrition nursing and monitoring the nutritional, metabolic, and clinical status of the patient. Therefore, the purpose of this study is to summarize the establishment and application of home nutrition nursing and follow-up management pattern for patients with intestinal failure in our center.

MATERIALS AND METHODS

Study design and participants

This retrospective study included patients with IF who received nutrition treatment in the Clinical Nutrition Treatment Center of Jinling Hospital between January 2018 and April 2022. The inclusion criteria were 1) age at least 18 years; 2) stable clinical condition; 3) expected duration of nutritional support > 4 weeks; 4) patients and their families consenting to HN. Patients receive appropriate HN nursing and follow-up management according to standard protocols from the nutrition support team.

Home nutrition nursing and follow-up management pattern

Within 24 hours of admission, the trained nursing staff will assist clinicians in assessing the patient's nutritional status by measuring the patient's body composition and assessing physical function according to standard protocol. Then clinicians conduct nutritional risk screening and nutritional status assessment based on patient history, laboratory nutritional indicators, and body composition. Appropriate nutrition therapy was provided according to standard protocol during hospitalization. Types of nutritional therapy include enteral, parenteral, ONS, or a combination of the above. Supplements of electrolytes, vitamins, and micronutrients are given based on laboratory tests weekly.

The nursing staff performed weekly body composition tests, guided patient resistance exercises, and maintained nutritional support pathways. For patients with impaired body function (low muscle mass and strength), it has been demonstrated that exercise training could promote the utilization of nutrients and improve nutritional status[8,9]. So we encourage IF patients to perform impedance training to prevent sarcopenia. Nursing staff provided equipment and recorded standard videos to guide IF patients complete four sets of exercises. It includes two sets of lower limb exercises (legs elastic-belt training, squat standing training), a set of upper limbs (upper limb elastic-belt training), and a set of abdominal and lumbar back

muscle groups (elastic-belt assisted sit-up training). We recommend that patients exercise at least 3 times a week.

The nutrition fluid delivery line has always been considered a lifeline for patients with IF, which makes their care especially important. The ESPEN guidelines on home enteral nutrition recommend the use of the nasal feeding tube or percutaneous endoscopic gastrostomy /jejunostomy (PEG/J) for enteral nutrition delivery based on the expected duration of treatment.[10] The nutrition nursing staff daily checks the length of the exposed part of the tube and ensures it is securely fixed and unobstructed. For patients with PEG/J, infection around the wound exit site and the situation of granulation tissue are noticed.[7]

Malnourished intestinal failure patients often have weakened immune function. High glucose concentrations and hypertonic pressure of PN fluids, long-term placement of venous catheters for HPN are also risk factors for infection in IF patients.[11] To reduce the incidence of infection, adequate preparation was carried out before the placement of the venous catheter: before 3 days of operation, the skin was cleaned with soap water and clean water daily, covering the skin of both arms from the upper jawline and down to the wrist. Clean and change dressing once a week after catheterization. This venous catheter is only used for PN liquid infusion, and pain attention to avoid line compression distortion during the process. When the patient develops symptoms such as chills, high fever, catheter obstruction, pain/local redness, and inflammation, the nursing staff will report to the clinician for timely treatment.

The nursing staff educated patients and caregivers to implement HN before discharge. The content of education mainly includes dietary guidance for patients with IF, safe operation of infusion pumps, proper storage of nutrient solutions, and maintenance of nutritional management. Through telephone, Internet, or outpatient follow-up visits, nutritional nursing staff complete monthly follow-up visits after discharge. The home visiting staff was assessed for weight, body composition, and nutritional status following standard procedures.[7]

Measurement of body composition and physical performance

The Inbody S10 (Inbody Co, Ltd., Seoul, South Korea) was selected to measure patients' body composition in this study. This equipment is based on direct-segmental multi-frequency bioelectrical impedance analysis (BIA), which could measure and calculate the content of various body compositions, including total body water (TBW), skeletal muscle mass (SMM), appendicular skeletal muscle mass (ASM), percent body fat (PBF), fat-free mass (FFM), phase angle (PhA), etc. The body mass index (BMI), fat-free mass index (FFMI), skeletal

muscle mass index (SMI), and appendicular skeletal muscle mass (ASM) were calculated as Weight (kg), FFM (kg), SMM, and ASM divided into by squared height (m), respectively. The requirements for preparation before BIA testing were as in our previous study.[7] Low muscle mass is defined as ASMI<7.0 kg/m^2 in men and <5.7 kg/m^2 in women by BIA. Handgrip strength (HG) and 6-m walk test were performed to evaluate the patient's somatic function. Low muscle strength is defined as handgrip strength <28 kg for men and <18 kg for women. Low physical performance is 6-m walk <1.0 m/s.[12]

Statistical analysis

Categorical variables were shown as frequency and relative percentages. For continuous variables, mean ± standard deviation (SD) or median (first-to-third interquartile range, IQR) were expressed according to whether the data were normally distributed or not. Paired sample t-test was adopted to compare the nutritional indicators and body compositions of IF patients before and after standardized management. All statistical analysis was using SPSS 21.0 software (Statistical Program for Social Sciences, SPSS Inc, Chicago, IL, USA) and a value of p<0.05 was considered statistically significant.

Ethical statement

The present study was approved by the Ethics Committee of Jingling Hospital and conformed to the ethical guidelines of the Declaration of Helsinki. All participants or their caregivers obtained written informed consent following the Austrian law and Research Ethics Committee guidelines and the anonymity has been preserved. The trial was registered at the Chinese Clinical Trial Registry (ChiCTR2000035145).

RESULTS

Basic characteristics

As shown in Table 1, a total of 65 patients with IF (BMI was 17.9 ± 2.7 kg/m^2, mean age 52.4 ± 15.8 years) were included in the analysis, with 73.8% and 26.2% patients were male and female, respectively. The main type of SBS were Jejunocolonic anastomosis (55.4%) and jejuno-ileal anastomosis (33.8%). In addition, the most reasons for SBS were mesenteric infarction (52.3%), neoplasms (13.8%) and intestinal volvulus (12.3%).

Biochemical nutritional indicators

After the application of home nutrition nursing and follow-up management pattern, the serum concentrations of biochemical nutritional indicators (albumin and prealbumin) were significantly higher in IF patients, compared with the prehospital values (p<0.01) (Table 2).

Change of body composition

Compared with before application of this pattern, the BMI, FFMI, and SMI were significantly increased (p<0.05) after the application of home nutrition nursing and follow-up management, as shown in Table 3.

DISCUSSION

Establishment of follow-up management pattern for patients with intestinal failure under team cooperation

Due to the particularity of patients with intestinal failure, we established the standardized home nutrition nursing and follow-up management pattern for the family nutrition follow-up. In the process of follow-up work, nursing staff should notice and record the nutritional status of patients at different stages of the disease, timely communicate with clinicians for personalized treatment plan adjustment, and then gradually optimize the nursing and follow-up pattern. The medical staff is required to evaluate the intestinal absorption capacity accurately and observe the intestinal mucosal morphology by gastrointestinal imaging or endoscopy during the development of a follow-up plan. In addition, it is necessary to carry out regular nutritional monitoring and follow-up for patients, not only to pay attention to IVs and energy control, but also to clarify hematological monitoring indicators and interval time, and prevent the occurrence of sarcopenia.[13,14]

For IF patients whose primary diseases were tumors, inflammatory bowel disease, mesenteric vascular disease, etc., individualized relevant examination and drug treatment should be clarified. Regular blood tumor markers tests are recommended for IF patients with tumors. When considering tumor recurrence through the comprehensive evaluation of radiographic examination and laboratory examination, guided patients to undergo specialized treatment of tumor, including radiotherapy and chemotherapy, and the use of immune enhancers and immunonutrition (n-3 PUFA, glutamine, arginine, etc.) on the premise of ensuring nutritional status.[15-17] For IF patients with inflammatory bowel disease, regular examination of fecal calprotectin, ESR, etc., and evaluation of disease activity degree according to the CDAI index.[18] When patients are in the clinical activity period, medical therapy including 5-aminosalicylic acid, glucocorticoids, immunomodulators, biological agents, etc. should be considered to induce and maintain remission.[19] Patients with intestinal

failure due to mesenteric vascular disease require nutritional therapy and intestinal angiography to assess the blood supply to the intestinal mucosa. Otherwise, the use of anticoagulants also needs to be considered.[20]

Home Nutrition nursing for patients with intestinal failure led by specialized nurses

Under the cooperation of the medical team, the multi-mode follow-up and education of the nursing are also part of the family nutrition support system for patients with intestinal failure. Essentially, family nutrition under the guidance of NST is an extension of in-hospital nutrition treatment.[21] Our family nutrition nursing staff solve professional nursing problems for IF patients and their caregivers through accurate nutrition evaluation and standardized follow-up and management pattern. This is conducive to improving the safety and feasibility of family nutrition therapy for patients with IF, and better solving the problems encountered in family nutrition conditions. With the advancement of the Multiple disciplinary teams (MDT), we continuously optimize and integrate nursing resources for difficult nursing problems identified during follow-up. For IF patients who had complicated and difficult ostomy and venous catheter maintenance-related difficult nursing problems, the wound care consultation center and the intravenous care and management center in the hospital were jointly consulted to help them.

Based on completing the evaluation, recording, and nutritional monitoring of the form, the follow-up of home enteral and parenteral nutrition complications was systematically classified and recorded, and the follow-up problem framework was established.[22,23] According to the primary disease of patients with intestinal failure, the special treatment and examination needed to be customized to improve the follow-up program. The WeChat mobile application nursing consultation was adopted, to solve nursing problems for family nutrition patients and improve the quality of nursing services. The establishment of a network visiting platform based on information background and various communication media ensure that intestinal failure patients can get help and solve problems in family nutrition support promptly. Improve the nursing effect during nutritional support therapy by helping patients to maintain nutritional pathways and ensuring that patients complete nutritional support therapy. Meanwhile, we establish the family nutrition database of IF patients to sum up the experience and accumulate data for promoting the family nutrition treatment of intestinal failure patients in the future.

Conclusion

The establishment and application of home nutrition nursing and follow-up pattern could ensure the nutritional support effect and improve the nutritional status and body composition of patients with intestinal failure.

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AUTHOR DISCLOSURE

The authors declare no conflict of interest.

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Table 1. Patients and disease characteristics at baseline.

Variable	Range
Total	65
Gender	
Male	48 (73.8%)
Female	17 (26.2%)
Age (years)	52.4±15.8
Height (cm)	167.5±6.1
Weight (kg)	50.1±8.0
BMI （kg/m^2）	17.9±2.7
Types of SBS	
End-jejunostomy	7 (10.8%)
Jejunocolonic anastomosis	36 (55.4%)
jejuno-ileal anastomosis	22 (33.8%)
Length of remaining intestine (cm), media (IQR)	70.0 (50.0-115.0)
Cause of SBS	
Surgical complications	7 (10.8%)
Mesenteric infarction	34 (52.3%)
Neoplasms	9 (13.8%)
Radiation enteritis	1 (1.5%)
Crohn's disease	0 (0.0%)
Abdominal trauma	3 (4.6%)
Benign conditions	3 (4.6%)
Intestinal volvulus	8 (12.3%)
Length of stay (d), media (IQR)	29.0 (19.0-39.5)

BMI: body mass index; SBS: short bowel syndrome; IQR: interquartile range; SD: standard deviation.
Data were shown as number of participants (%) or mean±SD unless otherwise noted.

Table 2. The change of serum concentrations of biochemical nutritional indicators before and after the pattern

	Before	After	*p*
RBC count (*10^12/L)	3.4±0.7	3.9±0.6	<0.001
Hemoglobin (g/L)	108.3±21.0	124.2±19.8	<0.001
Albumin (g/L)	34.4±5.5	37.1±4.6	<0.001
Prealbumin (mg/L)	213.6±92.4	260.4±92.7	<0.001
Transferrin (g/L)	1.5±0.6	1.5±0.6	0.39

RBC: red blood cell.
Data were shown as mean±SD.

Table 3. Body composition change before and after the pattern

	Before	After	*p*
BMI (kg/m^2)	17.9±2.7	18.5±2.8	<0.001
TBW (L)	31.2±5.1	31.9±4.8	0.11
BCM (kg)	26.9±4.5	27.5±4.2	0.10
BMC (kg)	2.6±0.5	2.7±0.4	0.07
FAT (kg)	7.7±5.6	8.2±5.6	0.12
PBF (%)	14.8±9.6	15.3±9.3	0.52
FFM (kg)	42.4±6.8	43.3±6.5	0.11
FFMI (c)	15.1±2.0	15.5±2.2	0.02
SMM (kg)	22.5±4.0	23.0±3.8	0.10
SMI (kg/m^2)	8.0±1.2	8.2±1.2	0.04
ASM (kg)	18.4±5.1	18.9±3.1	0.86
ASMI (kg/m^2)	6.6±1.6	6.7±1.1	0.73
VFA (cm^2)	38.7±21.8	40.2±21.5	0.34
BMR (kcal)	1286.4±147.8	1306.6±140.4	0.10
PhA (°)	4.4±2.8	4.4±0.9	0.87

BMI: body mass index; TBW: total body water; BCM: body cell mass; BMC: bone mineral content; FAT; PBF: Percent Body Fat; FFM: fat-free mass; FFMI: fat-free mass index; SMM: skeletal muscle mass; SMI: skeletal muscle mass index; VFA: visceral fat area; BMR: basal metabolic rate; PHA: phase angle.