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CLINICAL NUTRITION RESEARCH

Case Report

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Intensive Nutrition Management in a Patient with Short Bowel Syndrome Who Underwent Bariatric Surgery

MeeRa Kweon[1,2] **Dal Lae Ju**[1,2] **Misun Park**[1,2] **JiHyeong Choe**[2,3] **Yun-Suhk Suh**[2,4,5] **Eun-Mi Seol**[2,6] **Hyuk-Joon Lee**[2,4,5]

[1]Department of Food Service and Nutrition Care,Seoul National University Hospital, Seoul 03080, Korea
[2]Nutritional Support Team,Seoul National University Hospital, Seoul 03080, Korea
[3]Department of Pharmacy,Seoul National University Hospital, Seoul 03080, Korea
[4]Division of Gastrointestinal Surgery,Department of Surgery,Seoul National University College of Medicine, Seoul 03080, Korea
[5]Cancer Research Institute, Seoul National University College of Medicine, Seoul 03080, Korea
[6]Department of Nursing Service,Seoul National University Hospital, Seoul 03080, Korea

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Correspondence to
Hyuk-Joon Lee
Department of Surgery, Seoul National University College of Medicine, 103 Daehak-ro, Jongno-gu, Seoul 03080, Korea.
Tel: +82-2-2072-1957
Fax: +82-2-766-3975
E-mail: appe98@snu.ac.kr

ORCID iDs
MeeRa Kweon
https://orcid.org/0000-0002-1602-8097
Dal Lae Ju
https://orcid.org/0000-0002-3251-0932
Misun Park
https://orcid.org/0000-0001-6157-4380
JiHyeong Choe
https://orcid.org/0000-0002-9321-5953
Yun-Suhk Suh
https://orcid.org/0000-0003-3319-8482
Eun-Mi Seol
https://orcid.org/0000-0003-0983-9876

ABSTRACT

Many individuals with short bowel syndrome (SBS) require long-term parenteral nutrition (PN) to maintain adequate nutritional status. Herein, we report a successful intestinal adaptation of a patient with SBS through 13 times intensive nutritional support team (NST) managements. A thirty-five-year-old woman who could not eat due to intestinal discontinuity visited Seoul National University Hospital for reconstruction of the bowel. She received laparoscopic Roux-en-Y gastric bypass (RYGB) due to morbid obesity in Jan 2013 at a certain hospital and successfully reduced her weight from 110 kg to 68 kg. However, after a delivery of the second baby by cesarean section in Jul 2016, most of small bowel was herniated through Peterson's defect, and emergent massive small bowel resection was performed. Thereafter, she visited our hospital for the purpose of intestinal reconstruction. In Sep 2016, she received side–to-side gastrogastrostomy and revision of double barrel enterostomy. The remaining small bowel included whole duodenum, 30 cm of proximal jejunum, and 10 cm of terminal ileum. Pylorus and ileocecal valves were intact. The patient given only PN after surgery was provided rice-based soft fluid diet after 10 day of operation. Through intensive nutritional management care, she could start solid meals, and finally stop the PN and eat only orally at 45 days postoperatively. Three nutritional interventions were conducted over 2 months after the patient was discharged. She did not require PN during this period, and maintained her weight within the normal weight range. Similar interventions could be used for other patients with malabsorption problems similar to SBS.

Keywords: Short bowel syndrome; Intensive nutritional management; Oral intake

INTRODUCTION

Short bowel syndrome (SBS) is a rare, complex clinical condition caused by the loss of intestinal absorptive capacity due to surgical resection, congenital defect, or disease [1-3]. Adult patients with SBS are highly heterogeneous, presenting with a wide range of underlying pathological conditions, length and function of the remaining bowel, and psychosocial

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Conflict of Interest
The authors declare that they have no competing interest.

characteristics. The symptoms of SBS vary from patient to patient; however, they are typically characterized by diarrhea, fatty stools, abdominal pain, malnutrition, and dehydration [4,5].

The malnutrition associated with SBS progressively impairs the function of all bodily systems, diminishing overall health and quality of life. Sufferers of SBS have an increased susceptibility to diseases, more intense complications of illness and surgery, and an increased recovery duration and elevated mortality risk [1].The outcomes of SBS patients depend on how well the remaining bowel adapts. A combination of pharmacological and nutritional therapies is used to support bowel adaptation. Decreasing stool output by increasing absorption improves nutritional health, hydration status, and overall quality of life. One of the key steps to reduce stool output is diet manipulation. The appropriate diet manipulation depends on the individual's intestinal anatomy, and considerable education and ongoing monitoring are required to ensure a success.

Although the SBS diet is quite similar for patients with and without colonic segments, there are a few key differences that should be noted [6]. Specifically, patients with SBS who still have a segment of their colon achieve better nutrient absorption and reduction in stool loss from a high complex carbohydrate, low-moderate fat diet [1]. Therapies that decrease reliance on parenteral nutrition (PN) are of considerable importance. Intestinal adaptation results in morphological and functional changes that increase the performance of the remaining bowel, and occurs spontaneously after intestinal resection. These effects can be enhanced by nutrition and pharmaceutical approaches. For example, oral or tube-fed nutrients stimulate the growth and adaptation of intestinal tissues. Many patients with intestinal failure, particularly SBS, require long-term PN and/or intravenous (IV) fluids. Optimizing hydration and enteral nutrition (EN) through individualized dietary and pharmaceutical management for SBS can reduce or eliminate the need of PN/IV and improve outcomes for this patient population [7,8].

The management of patients with SBS is complex and requires a comprehensive, multidisciplinary approach and attention in detail. In the long term, the chances of achieving nutritional autonomy are improved by the use of appropriate oral diets coupled with adequate patient education and monitoring [9-11]. Therefore, multidisciplinary teams are vital for achieving optimal results [5,7,12].

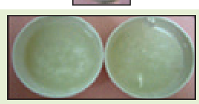
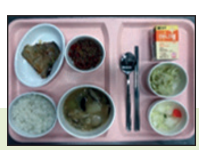
The purpose of this case report is to share our clinical experience about the intensive nutrition management of a patient with SBS who had a laparoscopic Roux-en-Y bypass (RYGB) while undergoing treatment for obesity. This case report was approved and the requirement for informed consent was waived by the Institutional Review Board of the Seoul National University College of Medicine (H-1706-117-861).

CASE

A thirty-five-year-old woman had received laparoscopic RYGB due to morbid obesity (body mass index [BMI] = 38.5 kg/m^2) in January 2013 at a certain hospital and successfully reduced her weight from 110 to 68 kg. However, after a delivery of the second baby by cesarean section on July 17, 2016, most of small bowel was herniated through Peterson's defect and emergent massive small bowel resection was performed. Resection range covered from gastrojejunostomy (GJ) site to the distal ileum around upper 30 cm from ileocecal (IC) valve. About 50 cm of afferent loop was also preserved. Closure of GJ site and double barrel enterostomy was made with drainage nasogastric tube insertion. Thereafter, the patient who could not eat due to intestinal discontinuity, visited Seoul National University Hospital for the purpose of intestinal reconstruction. In September 2016, she received side-to-side gastrogastrostomy and revision of double barrel enterostomy. The remaining small bowel included whole duodenum, 30 cm of proximal jejunum, and 10 cm of terminal ileum. Pylorus and IC valves were intact.

We provided 13 times of intensive nutrition management and follow-up care sessions while the patient was hospitalized. As part of the intensive nutritional care package, we supplied meals that progressed from a soft fluid diet (SFD) to a soft bland diet (SBD) and further to a normal regular diet (NRD). Over the course of the treatment, the patient's PN dependency decreased (**Table 1**). We recorded changes in nutritional intake and body weight throughout the treatment period.

Table 1. Nutritional management

Counseling	Date	Diet		Nutritional intervention	Oral intake, kcal	PN	Defecation, times/day
	2016.7.7–9.25 (before admission)					Data not available	
	2016.9.26 (admission)	NPO				1,350 kcal (protein 70 g)	
Visit #1–2	2016.9.30 2016.10.10	SFD		· Rice-based SFD start	0 → 100	1,648 kcal (protein 105 g)	0
Visit #3	2016.10.11	Rice-SBD + encover		· SFD → rice-SBD · Encover 100 kcal try	100 → 200	1,648 kcal (protein 105 g)	3 → 4 · Watery
Follow-up	2016.10.15	SBD (#6) + encover		· Frequent meals (#6) + 2 snacks · High protein diet (2,000 kcal, protein 110 g)	200 → 700 (protein 10 → 40 g) (mainly carbohydrate, protein)	1,600 kcal (protein 75 g)	8 → 11 → 9 → 3 (medication change) · Add PPI, loperamide · Defecation decreased
Visit #4–5 + follow-up 3 times	2016.10.17–10.27	SBD (#6) (individual adjustment)		· Add glutamine 10 g/day · Add soup (to enhance intake)			
Visit #6 + follow-up	2016.11.1 2016.11.3	NRD + ONS (bland diet)		· SBD → NRD (#3) · Increase nutrient density · High protein diet (2,400 kcal, protein 130 g) · ONS	700–1,000 (protein 40 g)	1,036 kcal (protein 49 g)	3–4
Follow-up	2016.11.9	NRD + ONS (bland diet)		· Encourage oral intake	1,000–1,200 (protein 60 g) · PN D/C (11.11–)	520 kcal (protein 24 g)	1–3
Visit #7	2016.11.15 (discharge)			· Educate diet management after discharge · Multivitamin recommendation	1,400–1,500 (protein 80–90 g)	0	3
OPD follow-up #1	2016.12.9	NRD		· Add MCT oil	1,600–1,700 (protein 80–90 g)	0	1–8 (small amount)
OPD follow-up #2	2017.1.13	NRD · Oral intake decreased (especially protein intake) · Nutrient density decreased		· Meal adjustment to prevent weight loss · Increase nutrient density	1,500–1,600 (protein 70 g)	0	4–6
OPD follow-up #3	2017.2.6	NRD		· Goal: weight maintenance · Educate low oxalate diet	1,900–2,000 (protein 95 g)	0	4

PN, parenteral nutrition; NPO, nil per os (nothing through the mouth); SFD, soft fluid diet; SBD, soft bland diet; PPI, proton pump inhibitor; NRD, normal regular diet; ONS, oral nutrition supplement; OPD, period of discharge; D/C, discontinue; MCT, medium-chain triglyceride.

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Nutrition management

Immediately after surgery, the patient received PN only. Nutritional needs were estimated using the following formulas; 25–35 kcal/kg ideal body weight (IBW)/d and 1.5–2.0 g protein/kg IBW/d. Total parenteral nutrition (TPN) was initiated based on 28 kcal/kg IBW/d and 1.8 g protein/kg IBW/d. The patient's input/output, body weight, and clinical status were monitored for adjusting TPN, and no significant weight loss was observed during PN administration.

Most of days, commercial 3-in-1 PN was administered, but customized PN was used for 5 days due to electrolytes imbalance. As long-term PN was expected, we used fish oil based IV fatty acid, and daily dose of multivitamins and trace elements were added to PN. During the administration of PN, trace elements and multivitamins were supplied in PN at the recommended level. Serum levels of vitamin B_{12}, folate, zinc, and copper were measured every 2 weeks after surgery, and all three measurements were maintained within normal ranges. We recommended vitamin supplements to the patient when she was discharged.

She started a rice-based SFD on 10th day after the operation, and then proceeded to SBD under intensive clinical dietitian's monitoring. Starting at the first solid meal, the patient was given a low fat, low fiber diet having 6 meals a day. Depending on the patient's tolerance, as indicated by the volume and frequency of stool, we adjusted meal progress and details. Nutrition support team (NST) advised modification of medication to decrease diarrhea and after she was able to increase oral intake more. Glutamine and oral nutritional supplements (ONSs) were temporarily tried to increase nutrient intake. We recommended her to consume glutamine powder mixed in the water.

One month after later, the intake through PN had decreased to 60% of the initial level. On 35th day after the operation, the patient progressed to the NRD. PN was tapered out with minimal weight loss under monitoring weight change and oral intake. The patient was discharged from the hospital on the 45th day after the operation. At this point her oral intake was approximately 1,500 kcal and she required PN no longer (**Figure 1A** and **1B**).

Three nutritional interventions were performed over 2 months after the patient was discharged. After discharge the patient experienced about 1–2 kg of weight loss. We encouraged her to use medium-chain triglyceride (MCT) oil for the prevention of weight loss as calorie supplementation and also advised her to avoid high fat and keep low oxalate diet to prevent kidney stones after her oral intake was adequately maintained.She was well tolerated, therefore maintained a normal range of body weight and did not use PN.

At the time of admission, she was assessed as having moderate to severe malnutrition risk, considering that she relied on only PN for 3 months with hypoalbuminemia (serum albumin 2.9 g/dL) and anemia (hemoglobin 11.0 g/dL). But at the last visit for counseling after-discharge, her nutritional status was improved. She could maintain a normal range of body weight through oral intake without PN and biochemical parameters (serum albumin 4.2 g/dL, hemoglobin 13.7 g/dL) were improved.

Weight change

Upon admission, the patient's height was 169 cm and her weight was 65.5 kg; her BMI was 22.9 kg/m^2. **Figure 2** shows the patient's body weight from the day after the operation to 2 months after discharge.The weight loss from admission to discharge was maintained within

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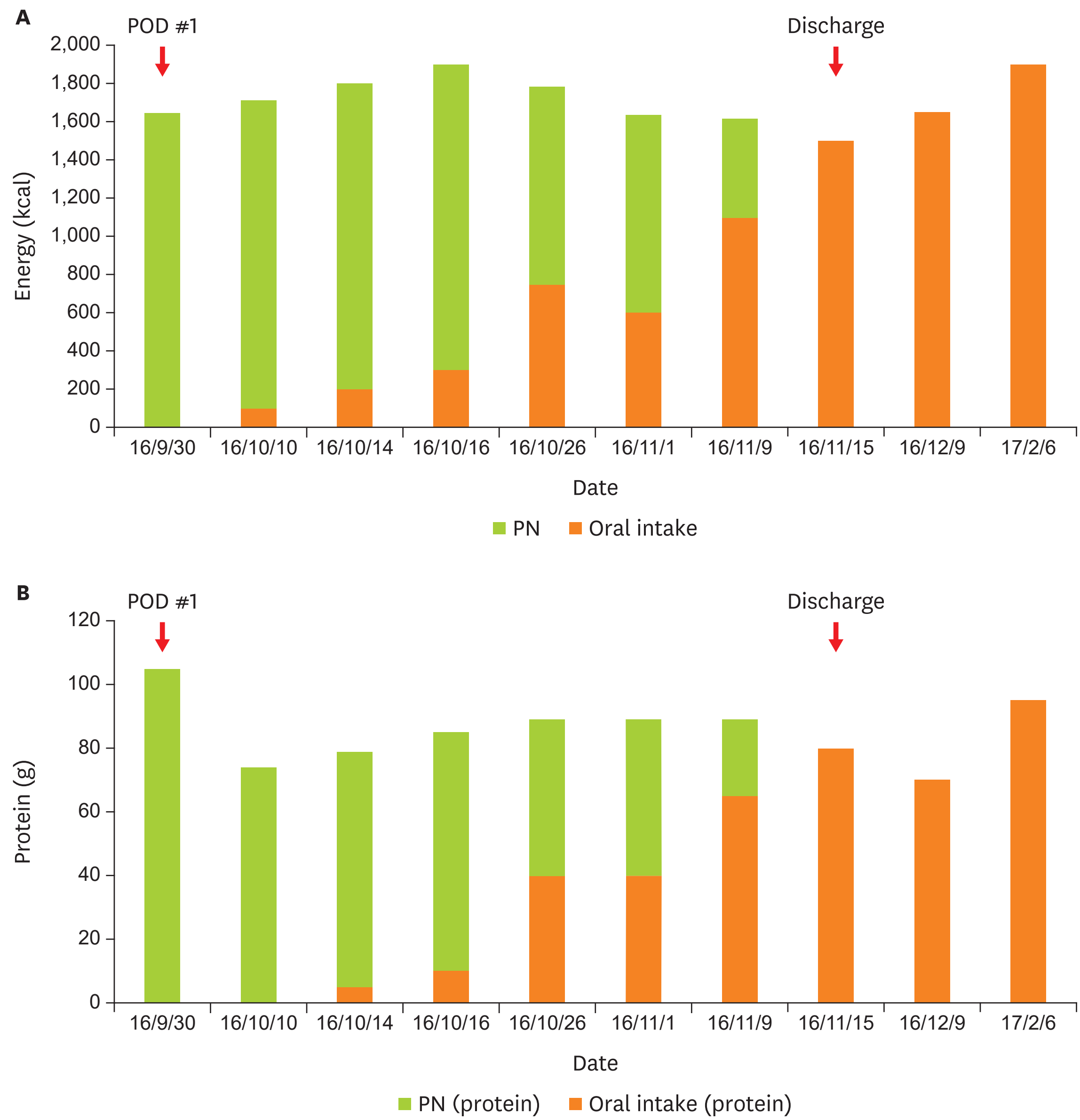

Figure 1. Change in intake by route for (A) energy and (B) protein.
POD, postoperative day; PN, parenteral nutrition.

around 1 kg. When the PN was stopped, the patient lost a small amount of weight, but her weight was in the ideal range of weight.

DISCUSSION

Managing patients with SBS is complex and requires a comprehensive, multidisciplinary approach and attention in detail. Although there are limited data regarding nutritional management of patients with SBS, it is apparent in terms of clinical practice that careful and meticulous nutritional intervention can facilitate weaning from PN. The long-term likelihood of achieving nutrition autonomy is improved by the use of appropriate oral diets coupled with

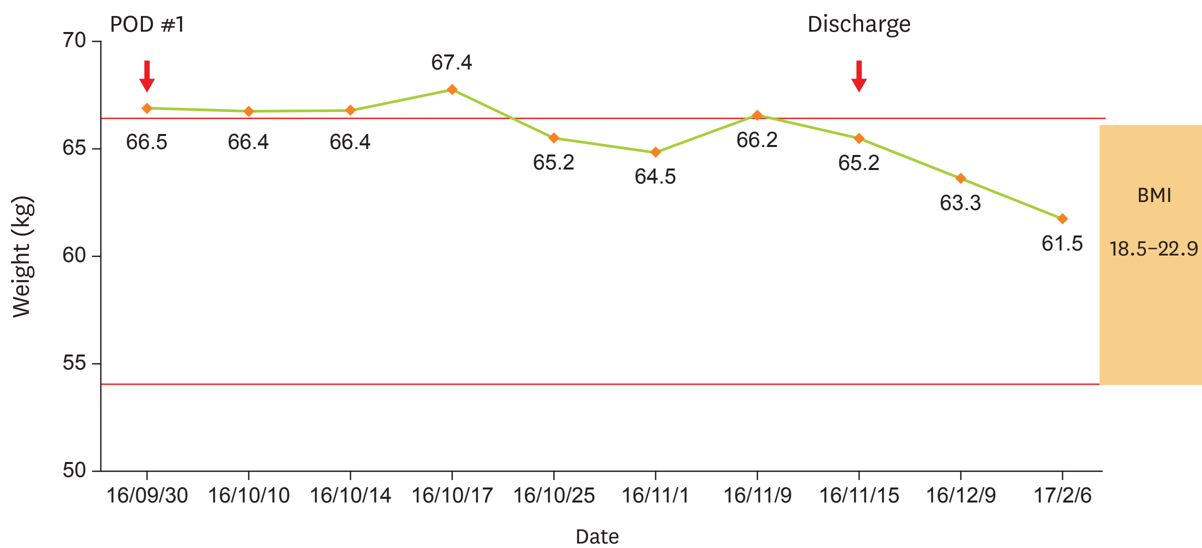

Figure 2. The patient's weight over the course of the intervention.
POD,postoperative day; BMI, body mass index (kg/m²).

education and monitoring [9]. We supplied the patient with a rice-based SFD from the 10th day after her intestinal reconstruction. She then proceeded to rice-based porridge, followed by next-step diets comprising 6 meals and 2 snacks.

The most important dietary interventions for patients with SBS include recommendation of frequent and small meals, avoidance of all types of simple sugars, and encouragement of chewing foods many times. By eating complex carbohydrates rather than concentrated sugars, stool volumes are reduced in patients with SBS, and their nutritional absorption is enhanced. Low fiber and complex carbohydrates are readily digested and absorbed. Hence, these should be the primary calorie/nutrient source, regardless of the remaining bowel anatomy [6].

Protein requirements for patients depend on how far the disease has progressed. Many patients with SBS are malnourished, and may benefit from increased protein intake [9]. Protein sources with high biological values are always preferred rather plant protein. As nitrogen absorption is least affected by decreased absorptive surfaces, these patients do not generally require peptide-based diets, as their usual sources of dietary protein are sufficient. Oral glutamine is often recommended to patients with SBS; however, its clinical benefit is controversial. There is insufficient data to support its use for patients with SBS.

Micronutrient supplementation is necessary, particularly as patients are weaned from PN. Vitamin and mineral deficiencies are common in these patients, and they often have clinical signs of nutrient deficiencies. Recommendations of nutritional supplements are often based on clinical suspicion, as many factors alter serum levels [9].

The patient lost 1–2 kg over 2 months following her discharge from the hospital. We encouraged her to use MCT oil to prevent weight loss and increase her calorie intake. Fat is an excellent source of calories; however, depending on the remaining bowel anatomy, too much fat intake may exacerbate steatorrhea. This results loss of calories, fat-soluble vitamins, and divalent minerals through the stool. MCTs are often recommended for patients with SBS

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because they are absorbed directly across the mucosa into the bloodstream and then taken directly to the liver. However, MCTs do not promote gut adaption as long-chain fats do. The use of MCT as part of a daily diet plan is at best just that [6].

After confirming that the patient's oral ingestion was stable, we advised her to avoid high-fat foods and maintain a low-oxalate diet. The aim of these recommendations is to prevent kidney stones. Calcium oxalate stones are an unpleasant complication, and have been reported in as many as 60% of SBS patients. To avoid nephrolithiasis, patients should avoid high-fat- and high-oxalate-containing foods [6].

One of crucial tasks for a dietitian is to translate all the pertinent data into food and meal plans that meet the individual's preferences and lifestyle. Careful monitoring is required to establish daily calorie and fluid intake goals. Adjustments may be needed to ensure that the patient can tolerate the recommended diet. The need for adjustments is determined by monitoring of symptoms, stool output, micronutrient levels, weight changes, hydration status, and foods eaten. This ongoing monitoring also enables us to assess whether the patient comprehends the diet therapy [6].

Through intensive nutrition management by a multidisciplinary team, we recommended increasing oral intake for the patient with SBS who had recently undergone a small bowel resection. She started nutritional support with PN, and PN was tapered as oral intake increased. During the transition from PN to oral diet, patient was closely monitored to avoid under- or over-feeding. On the forty-fifth day after the operation, the patient was able to disconnect the PN and receive all her nutritional needs orally. Three nutritional interventions were instituted over 2months since discharge. Over this period, the patient was able to maintain her weight within a normal range of weight without PN.

In conclusion, nutrition therapy is crucial for the successful management of patients with SBS. Substantial and ongoing education at a level that is easy for patient/caregiver to understand is essential from the outset, and adequate time must be allotted for this purpose. As the bowel adapts and absorption improves, it is possible that dietary recommendations can be liberalized. Patients with SBS require lifelong monitoring, and management goals often change over time [6].We expect this study to be used as an example of the effect of intensive nutritional management for patients with malabsorption issues such as SBS.

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