

Case Report



Diet Modification Based on the Enhanced Recovery After Surgery Program (ERAS) in Patients Undergoing Laparoscopic Colorectal Resection

Ji Yeon Kim,¹ Gyung Ah Wie,¹ Yeong Ah Cho,¹ So Young Kim,¹ Dae Kyung Sohn,² Suk Kyoung Kim,² Mee Duck Jun²

¹Department of Clinical Nutrition, Research Institute & Hospital, National Cancer Center, Goyang 10408, Korea

²Center for Colorectal Cancer, Research Institute & Hospital, National Cancer Center, Goyang 10408, Korea

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Correspondence to

Gyung Ah Wie

Department of Clinical Nutrition, Research Institute & Hospital, National Cancer Center, 323 Ilsan-ro, Ilsandong-gu, Goyang 10408, Korea.

E-mail: gawie@ncc.re.kr

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Conflict of Interest

The authors declare that they have no competing interests.

ABSTRACT

The enhanced recovery after surgery (ERAS) program aims to maximize the recovery of patients by minimizing pre- and postoperative complications and stress. The program recommends providing preoperative carbohydrate (CHO) supplements and starting an early postoperative diet to reduce the fasting duration. Based on these recommendations, we implemented preoperative CHO supplementation and initiated an early postoperative diet in patients undergoing laparoscopic colorectal resection. We observed 3 patients as follows: a non-ERAS case, preoperative ERAS case, and pre- and postoperative ERAS case. The preoperative well-being and compliance of patients improved after implementation of the ERAS program. Moreover, the length of hospital stay was reduced. Therefore, we consider that the ERAS program may be helpful for the recovery of patients undergoing laparoscopic colorectal resection.

Keywords: Carbohydrate loading diet; Early postoperative diet; Colorectal surgery; ERAS

INTRODUCTION

Maintaining fasting prior to gastrointestinal surgery is traditionally regarded as a standard guideline, as it reduces the risk of aspiration by eliminating gastric residuals [1]. Initiating an oral diet intake after the resumption of postoperative bowel movement is also common practice. Recently, the enhanced recovery after surgery (ERAS) program was developed, comprising a multimodal perioperative care program designed to promote early recovery in patients undergoing major surgery, including gastrectomy, pancreaticoduodenectomy, elective colonic surgery, elective rectal pelvic surgery, and radical cystectomy [2,3].

The ERAS program allows patients to consume solid food up to 6 hours and a 12.5% maltodextrin-form carbohydrate (CHO) supplement drink up to 2 hours prior to surgery to reduce the fasting period. The ERAS program demonstrated that this guideline reduces the risk of complications caused by aspiration during the induction of anesthesia because

it leaves no gastric residuals, significantly improves discomforts such as hunger, thirst, and anxiety, lowers insulin resistance, and maintains lean body mass after surgery [4,5].

In addition, the program recommends starting a liquid diet within 24 hours after surgery [1]. A solid diet is then introduced according to the patient's ability to comply. A shorter time to achieve adequate nutritional intake after colectomy has been associated with better recovery of bowel movement, a shorter hospital stay, and fewer postoperative complications [4]. There is evidence showing that the implementation of the ERAS program in colorectal surgery helps to reduce the complication rate and improves postoperative recovery [6,7].

Conventionally, patients undergoing colorectal surgery at our institution, the National Cancer Center (NCC), only consumed water or ionic beverages 2 days prior to surgery for bowel preparation, and fasted from midnight the day before surgery. In addition, the postoperative diet starts after confirming the passage of flatus and phases in soft fluid diet (SFD), soft blend diet (SBD), and normal regular diet. The diet protocol for patients undergoing laparoscopic colorectal resection at the NCC was modified based on the ERAS program recommendations. We administered preoperative CHO supplements and initiated early postoperative diet.

The purpose of this case report is to share our experience of applying the ERAS program in patients undergoing laparoscopic colorectal resection. This study was approved by the Ethics Committee of our institution (NCC 2017-0052).

CASE

We observed the following 3 patients undergoing laparoscopic colorectal resection: a non-ERAS case (patient 1), preoperative ERAS case (patient 2), and pre- and postoperative ERAS case (patient 3). The cases were matched in terms of sex, age, diagnosis, and nutritional status to avoid bias. The general characteristics of the patients are described in **Table 1**. All 3 patients were admitted by preoperative day 2 and given Coolprep® (Taejoon Pharmaceutical Co., Ltd., Seoul, Korea) for bowel preparation. They were asked to score their subjective well-being using a 10-cm visual analog scale, and their nutritional status was evaluated using the patient generated-subjective global assessment (PG-SGA) by a clinical dietitian prior to surgery. The

Table 1. General characteristics of the patients

Variables	Patient 1	Patient 2	Patient 3
	Non-ERAS	Preop ERAS	Pre and postop ERAS
Sex	Male	Male	Male
Age, yr	55	61	65
Diagnosis	Sigmoid colon cancer	Sigmoid colon cancer	Sigmoid colon cancer
TNM	T1N0M0	T2N1M0	T1N0M0
Operation	Laparoscopic-anterior resection	Laparoscopic-hemicolectomy	Lapa-anterior resection
Height, cm	168.4	165.0	163.7
body weight, kg	79.2	75.8	62.5
BMI, kg/m ²	28.7	27.8	23.3
PG-SGA	Well-nourished	Well-nourished	Well-nourished
Serum albumin, g/dL	4.0	4.2	3.9
Total lymphocyte count, cell/mm ³	1,980.7	3,136.3	2,528.4

Characteristics of the patients are shown below the data: Non-ERAS, traditional diet; Preop ERAS, preoperative carbohydrate supplement; Pre and postop ERAS, preoperative carbohydrate supplement + early postoperative diet; TNM, tumor size; lymph node status, distant metastasis by Union for International Cancer Control. ERAS, enhanced recovery after surgery; Preop, preoperative; Postop, postoperative; TNM, tumor, node, metastasis; BMI, body mass index; PG-SGA, patients generated-subjective global assessment.

Oncology Nutrition Dietetic Practice Group of the American Dietetic Association adopted the scored PG-SGA as a standard nutritional assessment tool for cancer patients.

The preoperative ERAS program was implemented as follows. A preoperative CHO supplement diet was developed in accordance with the ERAS program recommendation. The diet consisted of a total of 1,200 kcal of commercial 12.5% maltodextrin CHO supplement beverage (300 kcal/3 cans/meal) every 4 meals prior to surgery (**Table 2**). Dextrose was not administered intravenously. A clinical dietitian explained the preoperative CHO diet to the patients, providing information on how to take the supplement. The early postoperative diet comprising a SBD was initiated at postoperative day 2 regardless of the postoperative passage of flatus (**Table 2**).

Patient 1 was a 55-year-old man who was diagnosed with sigmoid colon cancer and well-nourished based on the PG-SGA. He was moderately obese with a body mass index (BMI) of 28.7 kg/m². He was given the traditional perioperative diet. After ingesting a small amount of rice at lunch on the day of admission, he drank only water prior to surgery. The patient received intravenous dextrose. The patient's subjective well-being scores were as follows: hunger, 8; thirst, 6; discomfort, 0; anxiety, 5; depression, 2; and fatigue, 3 (**Table 3**). His fasting time prior to surgery was 43 hours, and he started receiving SFD on postoperative day 3 (73 hours) after passage of flatus. The length of hospital stay was 10 days (**Table 4**).

Table 2. Comparison of pre-and postoperative diet in patients

	Patient 1	Patient 2	Patient 3
	Non-ERAS	Preop-ERAS	Pre and postop-ERAS
Pre-OP day #2	SOW	Preop CHO diet	Preop CHO diet
Pre-OP day #1	SOW	Preop CHO diet	Preop CHO diet
OP	NPO	NPO	NPO
POD#1	SOW	SOW	SOW
POD#2	SOW	SOW	SBD (1)
POD#3	After passage of flatus		SBD (2)
	SFD	SFD	
POD#4	SBD (1)	SBD (1)	NRD
POD#5	SBD (2)	SBD (2)	NRD
POD#6	NRD	NRD	Discharge
POD#7	NRD	Discharge	NA
POD#8	Discharge	NA	NA

Characteristics of the patients are shown below the data: Non-ERAS, traditional diet; Preop ERAS, preoperative carbohydrate supplement; Pre and postop ERAS, preoperative carbohydrate supplement + early postoperative diet; Preop CHO diet (meal), 300 kcal, carbohydrate, 76.8 g; SFD, 900 kcal, carbohydrate, 180 g, protein, 21 g; SBD (1), 1,100 kcal, carbohydrate, 180 g, protein, 45 g; SBD (2), 2,100 kcal, carbohydrate, 285 g, protein, 110 g; NRD, 2,200 kcal, carbohydrate, 305 g, protein, 115 g.

ERAS, enhanced recovery after surgery; Preop, preoperative; Postop, postoperative; OP, operative; POD, postoperative day; NPO, nil per os; SOW, sips of water; CHO, carbohydrate; SFD, soft fluid diet; SBD (1), soft blend diet step 1; SBD (2), soft blend diet step 2; NRD, normal regular diet.

Table 3. Subjective well-being of the patients*

Variables	Patient 1	Patient 2	Patient 3
	Non-ERAS	Preop ERAS	Pre and postop ERAS
Hunger	8	2	2
Thirst	6	0	2
Discomfort	0	0	2
Anxiety	5	0	2
Depression	2	0	2
Fatigue	3	0	2

Characteristics of the patients are shown below the data: Non-ERAS, traditional diet; Preop ERAS, preoperative carbohydrate supplement; Pre and postop-ERAS, preoperative carbohydrate supplement + early postoperative diet. Value are presented as score.

ERAS, enhanced recovery after surgery; Preop, preoperative; Postop, postoperative.

*Visual analog scale rated by patients.

Table 4. Comparison of the results according to the ERAS program

Variables	Patient 1	Patient 2	Patient 3
	Non-ERAS	Preop ERAS	Pre and postop ERAS
Intake of preoperative CHO supplement, kcal	0.0	1,200.0	1,200.0
Preop intravenous fluid, kcal	720.0	0.0	0.0
Preop fasting time, hr	43.0	16.6	17.9
Postop first flatus, hr	68.0	61.0	53.0
Postop first diet, hr	73.0	61.0	39.0
Length of stay, day	10.0	9.0	8.0
Weight loss, kg (%)	1.3 (1.6)	2.0 (2.7)	0.3 (0.5)

Characteristics of the patients are shown below the data: Non-ERAS, traditional diet; Preop ERAS, preoperative carbohydrate supplement; Pre and postop ERAS, preoperative carbohydrate supplement + early postoperative diet.

ERAS, enhanced recovery after surgery; Preop, preoperative; Postop, postoperative; CHO, carbohydrate.

Patient 2 was a 61-year-old man who was diagnosed with sigmoid colon cancer and well-nourished based on the PG-SGA. He was moderately obese, with a BMI of 27.8 kg/m². He received a preoperative CHO supplement of 1,200 kcal/4 meals. The patient's subjective well-being scores were as follows: hunger, 2; thirst, 0; discomfort, 0; anxiety, 0; depression, 0; and fatigue, 0 (**Table 3**). He started SFD at postoperative day 3 (61 hours) after passage of flatus. The length of hospital stay was 9 days (**Table 4**).

Patient 3 was a 65-year-old man who was diagnosed with sigmoid colon cancer and well-nourished based on the PG-SGA. His BMI was 23.3 kg/m². He received preoperative CHO supplementation and started an early postoperative diet. The patient's subjective well-being scores were as follows: hunger, 2; thirst, 2; discomfort, 2; anxiety, 2; depression, 2; and fatigue, 2 (**Table 3**). He started SBD on postoperative day 2, although passage of flatus occurred 53 hours after surgery. The patient experienced no discomfort when the postoperative diet was initiated. The length of hospital stay was 8 days (**Table 4**).

DISCUSSION

Nutritional status is an important indicator of successful postoperative outcomes [2]. Unfortunately, surgery-related stress due to certain factors, such as underlying disease and surgical procedures, can impair the nutritional status. Prolonged fasting prior to surgery may result in complications, such as distress, postoperative nausea and vomiting, and increased insulin resistance [8-10].

Daniele et al. [11] reported the prevalence of risk of malnutrition and stated that the malnutrition rate in patients undergoing surgery for colorectal carcinoma was 70.6%. Surgical patients are at high risk of malnutrition, which could lead to delayed wound healing, exposure to infection, gastrointestinal pathogenic bacteria proliferation, and reduced immunity. Accordingly, the ERAS program recommends preoperative CHO supplementation.

The preoperative CHO diet in the ERAS program has been shown to reduce postoperative insulin resistance and loss of nitrogen and protein, as well as preoperative thirst, hunger, and anxiety. A Cochrane Review showed that when patients consumed CHO supplements, their anxiety and hunger levels lowered correspondingly [12,13]. In our previous study, preoperative CHO supplementation was applied in hepatobiliary and pancreatic surgery. The present study demonstrated an improved preoperative well-being without an increase in insulin resistance.

In the present study, patient 1 showed increasing preoperative discomfort (hunger, thirst, and anxiety) compared with patients 2 and 3 (**Table 3**). In contrast to patient 1, 2, and 3, who received CHO supplementation, showed a decreasing trend in preoperative discomfort in terms of these 3 variables. The patient 2 and 3 are similar results of well-being score. The mean duration of hospital stay was 9.0 ± 0.8 (range, 8–10) days, and the mean postoperative weight loss was -1.2 ± 0.6 ($1.6\% \pm 0.8\%$) kg. Patient 3 had a shorter length of hospital stay compared with patients 1 and 2. Patient 3 showed the lowest weight loss among the 3 patients.

Fasting after surgery contributes to exacerbation of catabolism accompanied by weight loss [11]; however, an early postoperative diet may help improve the recovery of patients. In addition, the length of hospital stay and risk of complications decreased. The ERAS program considers an early postoperative diet as essential nutritional support for postoperative recovery [14].

Therefore, for conscious patients able to swallow, consuming a diet within 24–48 hours prior to all types of surgery could help promote postoperative recovery, reduce infectious complications, and shorten length of hospital stay. El Nakeeb et al. [6] showed that early oral feeding within 24 hours after colorectal resection was safely tolerated by 80%–90% of patients. Our pre- and postoperative ERAS case demonstrated improved patient compliance and reduced weight loss and length of hospital stay.

In conclusion, implementation of the ERAS program could improve postoperative recovery in patients undergoing colorectal resection. Further studies on the application of this program in various cases are required to validate the findings of this study.

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