Post-discharge Self-management of Food Intake in Distal Gastrectomy Patients

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ABSTRACT

This study aimed to evaluate the post-discharge dietary self-management practices and nutritional recovery of distal gastrectomy patients who had learned how to self-evaluate and maintain appropriate food intake during hospitalization.

A total of 29 patients were followed-up from admission to postoperative month 3 for: food intake, which was estimated from weight gain between before and after having a meal, and postprandial epigastric sensations and discomfort using a self-administered record form; post-discharge daily physical activity and step counts, from immediately after waking until just before going to bed, using an automated daily activity recorder; and body weight and the arm muscle circumference as measures of nutritional status.

Serial changes in food intake and meal frequency suggest their successful self-management practices regarding food intake, with food intake gradually recovering from 43% at discharge to 93.8% at postoperative week 13. Although their physical activity and step counts gradually increased after discharge, relative body weight and arm muscle circumference at postoperative week 13 (93.6% and 94.6%, respectively) were maintained from the time of discharge.

These findings demonstrate that, despite increased physical activity after discharge, patients maintained their nutritional status, possibly as a result of the successful self-management of food intake.

I. Introduction

The incidence of gastric cancer is higher in Japan[1]; however, the overall five-year survival rate has improved recently due to advances in diagnostic technology and the introduction of mass screening that allows for earlier detection. With most gastric cancer patients returning to work after surgery, improving quality of life (QOL) has become an important issue in nursing interventions.

Surgery is the first-line treatment for gastric cancer, the most common of which is distal gastrectomy. A previous survey of distal gastrectomy patients with Billroth I reconstruction demonstrated, based on patients' subjective assessment, that their food intake recovered to 80% of preoperative levels 6 months after surgery[2], and an endoscopic study quantitatively evaluating the gastric remnant of discharged patients revealed that the remnant stomach allowed a volume of 410 ml at 3 months postsurgery[3]. Previous studies reported that gastrectomy patients had a postoperative weight of approximately 90% that of the preoperative weight[4] [5], and their body weight did not recover more than 1 year after surgery[6] [7] [8]. A questionnaire survey conducted by a gastrectomy patient support group revealed that 95% of respondents had postoperative weight loss[9], 30% had long-term weight loss persisting for more than 2 years after surgery, and more than 60% encountered difficulties with diet after surgery[10]. Postoperative weight loss in gastrectomy patients has been attributed to a decrease in food intake, postprandial discomfort that often deters patients from increasing their food intake, increased physical activity after discharge despite insufficient energy intake, and increased frequency of diarrhea[11]. Furthermore, when considering the metabolic responses of the body to surgical stress, a shorter postoperative hospital stay implies that patients are discharged during a transition phase when the metabolism of muscle protein and body fat switches from a catabolic to an anabolic state. During the anabolic state, in which the body repairs damaged tissues and stores fat over subsequent months, it is necessary for patients to increase their energy intake to maintain and improve nutritional status.

Regarding the recovery of nutritional status after discharge, previous studies showed that postoperative body mass index (BMI) was lower in patients who had followed detailed dietary advice given by healthcare professionals than in those who had not[12], and that the eating behaviors of patients changed after returning to the workplace despite prior nutrition education from healthcare professionals[13], which raises concerns about the actual dietary practices of these patients and the effectiveness of current nutrition education interventions for gastrectomy patients. It is important to make full use of the physiological function of the remnant stomach at each time point of recovery, as well as reduce discomfort to ensure an adequate nutritional supply for nutritional recovery after discharge. In clinical settings, gastrectomy patients have conventionally been instructed at the initiation of postoperative oral intake to "eat 6 small meals a day", "chew food very well", and "spend 30 min eating each meal"; at discharge, they have been advised to "reduce meal frequency to 3 times a day after 3-6 months" and "make high-calorie, high-protein food choices". This approach merely provides patients with choices as to whether they follow the advice of health professionals, and they are less likely to use the advice as a rational basis to self-evaluate the recovery of the stomach to make appropriate decisions about food intake.

We developed a dietary education program to help postoperative gastric cancer patients learn how to self-evaluate and maintain appropriate food intake in relation to recovery of the remnant stomach. The characteristic feature of this program is that patients keep a record of their body weight before and after a meal to quantify their food intake objectively, along with postprandial epigastric sensations and discomfort, so that they can make an appropriate decision regarding subsequent food intake as well as increase their self-management skills over time. Our previous study

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demonstrated that this program helped distal gastrectomy (Billroth I reconstruction) patients to make appropriate self-management decisions about food intake during hospitalization [14]; however, the findings obtained suggested the need to assess the recovery of food intake and nutritional status after discharge in a long-term follow-up study. Therefore, this study aimed to evaluate post-discharge dietary self-management practices among distal gastrectomy patients who had participated in the dietary education program during hospitalization by assessing serial changes in their food intake, physical activity levels, and nutritional recovery.

II. Methods

1. Ethical procedures

This study was approved by the Ethical Committees of the Aichi Cancer Center (No. 12-29). All study participants provided written informed consent after receiving a written and verbal explanation of the purpose and procedures of the study, the non-consequential nature of participation refusal, and privacy considerations.

2. Patients

Of 67 gastric cancer patients who had undergone distal gastrectomy (with Billroth I reconstruction) followed by instruction sessions based on our dietary education program, 29 patients who gave consent for post-discharge follow-up participated in this study. These patients included 21 men and 8 women, with a mean age of 60.5 ± 11.2 years, mean BMI of 22.3 ± 3.2 at admission, and mean postoperative hospital stay of 14 ± 5 days.

3. Summary of dietary education program

Our dietary education program aimed to provide patients with rational bases to self-evaluate functional changes and recovery of the stomach during their in-patient stay and make appropriate self-management decisions about food intake and meal frequency after discharge. In this program, patients were given three sessions of instructions using a dietary education brochure. The topics consisted of the following: modifications to eating habits and food intake required after surgery (session 1); postoperative changes in gastric function, and rational bases for making self-management decisions about food intake (session 2); and food choices, how to make decisions about changing the frequency of meals after discharge, and target weight setting (session 3). These sessions were conducted in the above order before surgery, at the initiation of fluid intake, and at the time point at which patients advanced to a soft-rice diet.

In this program, patients objectively quantified their food intake, which is a characteristic feature of the program. More specifically, patients keep a record of their body weight before and after meal ingestion using a 50-g resolution health scale to determine postprandial weight gain and food intake. Additionally, patient records of postprandial epigastric sensations and discomfort served as basic resources for them to increase self-management skills.

Patients were instructed to use the following as rational bases to determine an appropriate meal size: "if you have no epigastric sensation or discomfort, increase your food intake by 50 g the next day," and "if you have epigastric sensations or discomfort, decrease or maintain the current meal size for the next meal." This information was described in the brochure and introduced in session 2. On the following day, during daily weight measurements before lunch, patients planned the size of the day's meals by choosing one from the response options listed in a self-administered record form as "increase, maintain, or decrease from the previous day", and recorded their choices. Nurses reviewed their choices once a day, provided patients with feedback regarding whether they had made an appropriate decision, and corrected inappropriate decisions.

In session 3, patients were given the following instructions to be used as rational bases for changing their meal frequency after discharge: "when you recover enough to consume nearly 2/3 of the preoperative size of a meal and have no weight loss, omit one meal (between-meal snack)." In addition, a target weight was set for each patient as follows: the weight at admission or that corresponding to a BMI of 22, whichever was less.

4. Procedures

Based on the program, patients measured their body weight before and after lunch every day for 3 days before surgery and during the postoperative period (after the initiation of postoperative food intake until discharge), and recorded postprandial weight gain on the self-administered form as a measure of food intake. They also kept a record of their food intake, i.e., weight gain between before and after having supper for three months after discharge, which was used as a measure of energy intake. Patients wore a daily activity recorder every day while awake, from immediately after waking until just before going to bed, to automatically record their physical activity and step counts taken as measures of energy expenditure. The measures of nutritional status used in this study were body weight and arm muscle circumference (AMC) estimated from arm circumference (AC) and triceps skinfold (TSF) measurements taken once a month. Details of the measuring instruments are described in the section below.

1) Self-administered record form

Patients recorded their planned meal sizes, body weight measurements before and after meal ingestion, meal times, and epigastric sensations and discomfort immediately and 1 hr after lunch on an A4-size form. The intensity of epigastric sensations was rated on a Likert scale from 0 (no sensation) to 6 (very intense). Regarding discomfort, a total of 21 symptoms, including the 18 symptoms designated in the diagnostic criteria for early dumping syndrome established by the Japan Society of Gastrointestinal Surgery, along with "eructation," "heartburn," and "general malaise," a hypoglycemic symptom, were listed on the form as response options, from which patients could choose those that matched their conditions. Additional items, including daily meal frequency, bowel movement frequency, and stool quality, were also recorded after discharge.

2) Instruments measuring energy intake

A precision digital weighing scale and a 50-g resolution

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health scale (FG-150KA and UC-321, respectively, A&D Company, Limited) were used before and after discharge, respectively.

3) Device measuring energy expenditure

Physical activity (kcal) and step counts were measured using a daily activity recorder (Lifecorder EX, SUZUKEN CO., LTD.), a device by which the intensity and cycle of acceleration during physical activity are measured and converted into energy expenditure (kcal). Its memory function allowed for the continuous automatic recording of measurements for 200 days, which is another characteristic feature of the device.

4) Instruments measuring nutritional status

Body weight was measured using the 50-g resolution health scale (UC-321). The AMC was calculated by the formula: AC -3.14 × TSF, using AC and TSF measurements determined with an Eiken skinfold calipers.

5. Data analyses

Energy intake, which was analyzed as a percentage of the postoperative to preoperative food intake (postoperative/mean preoperative food intake × 100; percentage food intake), and energy expenditure, including daily physical activity and step counts measured by the daily activity recorder, were assessed for each patient, averaged to weekly means up to postoperative week 13, and plotted graphically to examine the time courses. In the analyses of nutritional status, postoperative daily body weight data up to postoperative week 13 were assessed as a percentage relative to the preoperative weight (postoperative/preoperative weight × 100; percentage of preoperative weight) as well as a percentage to the target weight set at discharge (postoperative/target weight × 100; percentage of target weight), averaged to weekly means, and plotted graphically to examine serial changes. The AMC estimated as above was expressed as a percentage of the age- and sex-specific national average AMC[15] for comparison (estimated AMC/age- and sex-specific national average AMC × 100, percentage AMC). Self-management practices after discharge were evaluated for each patient regarding whether the two decision-making bases presented in the dietary education program, i.e., "consuming a meal size of greater than 2/3 of the preoperative size" and "having no weight loss", were met when they changed their meal frequency. The meal frequency observed on most of the days of a week was used as the representative value for the week.

6. Data reliability

We reviewed patient's records every day during their hospitalization. In addition, we accompanied patients to their pre- and postprandial body weight measurements and food intake assessment once before and twice after surgery to verify the correctness of their measuring procedures and measurement records, which consequently proved to be correct for the 81 measurements observed. During the post-discharge follow-up period, we conducted these validity tests once a month during their hospital visit (before and after lunch), in which 20 patients were found to follow the procedures as instructed, and 9 were lost to the tests due to clinical reasons.

III. Results

1. Patient characteristics

The tumor stages of the patients were IA (n=15), IB (4), II (3), IIIA (5), IIIB (1), and IV (1). The extent of lymph node dissection was D1+α (n=1), D1+β (5), D2 (22), and D0 (1). Of the 15 patients who had a job, 14 returned to work within 3 months after discharge. Oral intake was rescheduled in 2 patients with a postoperative anastomotic leakage, and delayed in 6 due to fever. Three patients received adjuvant chemotherapy.

2. Changes in food intake during 3 months after surgery

Daily food intake and percentage food intake relative to preoperative levels were calculated for each patient and averaged to weekly means up to postoperative week 13. The analyses of percentage food intake included 23 patients after excluding 6 who had participated in the study after surgery and had no preoperative food intake data. Changes in the mean food intake and mean percentage food intake by week after surgery are presented in Table 1, and the latter is graphically illustrated in Figure 1. The mean percentage food intake, i.e., a measure of recovery relative to the mean preoperative food intake of 617.6 ± 122.4 g (100%), was 25.3% at the initiation of food intake, increased to 43.0% at discharge, followed by 60.0%, 71.1%, and 81.6% at postoperative weeks 4, 6, and 9, respectively, and recovered to 93.6% (564.8 ± 159.3 g) at postoperative week 13, with 9 patients achieving a percentage food intake of 100%.

3. Changes in physical activity during 3 months after surgery

Daily physical activity and step counts measured during 3 months after discharge were averaged to weekly means for each patient. Changes in the mean daily physical activity and mean daily step counts by week after surgery are shown in Table 1 and Figure 1, respectively. The mean (range) daily physical activity was 75.9 (21-330) kcal at postoperative week 2 and gradually increased to 181.9 (33-431) kcal at postoperative week 13. The mean (range) daily step counts were 3,738 (886-16,429) and 7,832 (1,928-16,583) steps at postoperative weeks 2 and 13, respectively, showing a gradual increase over time.

4. Nutritional status during 3 months after surgery

1) Weight changes

Daily body weights were assessed for each patient as a percentage of the preoperative weight (% preoperative weight). Data were averaged for all patients to weekly means (Table 1). Serial changes in the relative weight by week after surgery are plotted graphically in Figure 1. The mean (range) percentage of preoperative weight was 97.7% (91.8%-105.7%) at the initiation of food intake, 94.1% (88.4%-101.1%) at discharge, and 93.6% (85.3%-102.8%) at postoperative week 13, respectively, resulting in a mean weight loss of 3.95 ± 3.2 kg at postoperative week 13 relative to preoperative values.

Body weight was also assessed as a percentage of the target weight determined for each patient upon discharge (i.e., the weight corresponding to a BMI of 22 for patients with a BMI of

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Table 1. Changes in the mean food intake, mean percentage food intake, mean daily physical activity, mean percentage of preoparative weight, and mean percentage of taget weight

Time point	Mean food intake	Mean percentage food intake	Mean daily physical activity	Mean percentage of preoperative weight	Mean percentage of target weight %	
	g	%	kcal	%	BMI≧22	BMI<22
Initial food intake	156.9±128.0 (29)	25.3±23.0 (21)	-	97.7±3.0 (27)	106.8±7.3 (15)	98.6±3.1 (12)
Discharge	267.2±89.9 (29)	43.0±19.2 (23)	-	94.1±2.8 (29)	103.3±7.7 (17)	95.9±2.6 (12)
Postoperative Week 2	317.0±107.1 (20)	47.8±17.1 (17)	75.9±72.2 (21)	95.1±2.3 (20)	105.6±8.2 (10)	96.0±2.5 (10)
Week 3	341.1±94.3 (25)	55.4±16.4 (21)	108.5±80.3 (25)	94.7±2.9 (24)	104.7±7.9 (14)	96.5±2.9 (10)
Week 4	364.5±97.0 (27)	60.0±17.1 (23)	117.6±100.8 (28)	94.2±3.2 (27)	103.6±8.4 (16)	96.6±2.8 (12)
Week 5	391.3±101.8 (28)	64.6±15.8 (23)	130.5±103.3 (27)	93.9±3.0 (28)	103.0±8.0 (15)	96.4±2.5 (12)
Week 6	431.8±114.2 (26)	71.1±17.1 (22)	139.3±99.9 (26)	93.6±3.3 (26)	103.1±7.9 (15)	96.2±2.5 (11)
Week 7	436.5±123.7 (27)	70.8±22.7 (23)	144.5±90.3 (26)	94.0±3.4 (27)	103.4±7.8 (15)	96.4±2.4 (12)
Week 8	468.7±135.5 (27)	76.1±25.4 (23)	152.5±83.2 (26)	94.0±3.8 (27)	102.9±7.5 (15)	97.0±2.7 (12)
Week 9	504.9±129.9 (27)	81.6±25.0 (23)	147.5±72.4 (26)	94.0±4.0 (27)	102.9±7.7 (15)	96.9±2.9 (12)
Week 10	521.5±155.2 (27)	85.0±26.2 (23)	174.7±92.6 (26)	94.1±4.0 (27)	103.1±8.0 (15)	97.0±2.9 (12)
Week 11	508.7±134.8 (27)	84.5±27.1 (23)	173.0±96.1 (26)	94.1±4.1 (27)	103.2±8.1 (15)	96.9±2.9 (12)
Week 12	517.4±155.2 (27)	85.9±26.4 (23)	161.0±82.9 (26)	93.9±4.3 (27)	102.8±8.5 (15)	96.9±3.1 (12)
Week 13	564.8±159.3 (26)	93.8±24.4 (23)	181.9±104.8 (24)	93.6±4.5 (26)	102.7±8.5 (15)	96.7±3.5 (12)

Note: Food intake indicated weight gain between before and after having a meal. The mean preoperative food intake was 617.6±122.4g. The target weight was defined as the weight corresponding to a BMI of 22 for patients with a BMI≧22, and the preoparative weight for those with a BMI of <22.

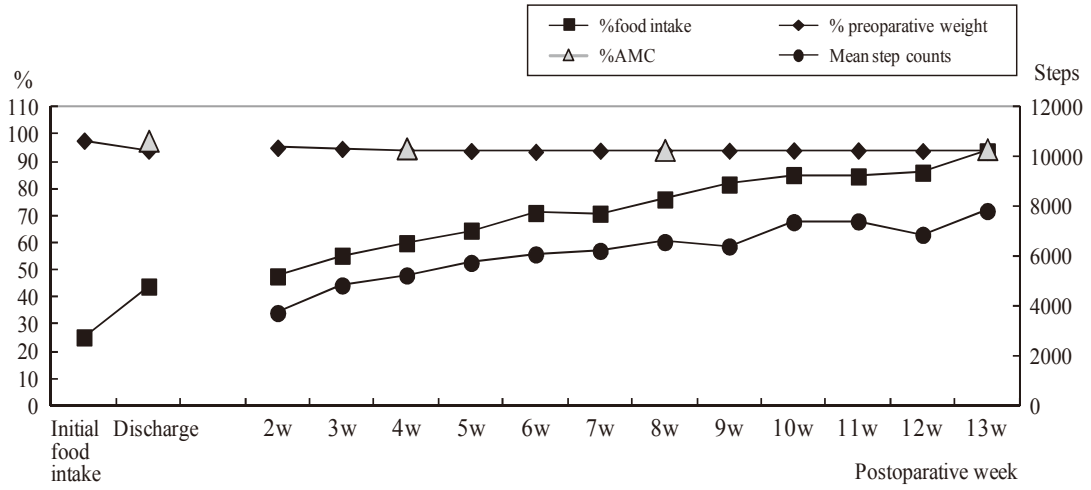

Figure 1. Serial changes in the mean percentage food intake, mean percentage of preoperative weight, mean percentage AMC, and mean step counts.

The mean percentage food intake, mean percentage of preoperative weight, and mean percentage AMC are indicated on the left ordinate, while the mean percentage AMC is shown on the right ordinate.

≥22 at admission, and the preoperative weight for the others). Data were summarized for each of the two BMI subgroups (Table 1 and Figure 2). The mean percentage of target weight (% target weight) in patients with an admission BMI of ≥22 was 103.3% at discharge and 102.7% at postoperative week 13, while the relative weight was 95.9% and 96.7% at the respective time points in those with an admission BMI of <22, showing no decrease. Of the 27 patients who were followed-up to postoperative week 13, 20 achieved a mean percentage of target weight of 95% or greater, 6 a mean of 90% to less than 95%, and 1 attained 88.1%.

2) Changes in the AMC

As shown in Figure 1, the mean (range) percentage AMC changed from 97.7 ± 9.5% (82.3%-119.1%, n=25) at discharge to 94.9 ± 7.5% (79.8%-112.1%, n=25), 94.3 ± 7.6% (77.1%-106.3%, n=26), and 94.6 ± 7.9% (79.0%-109.8%,

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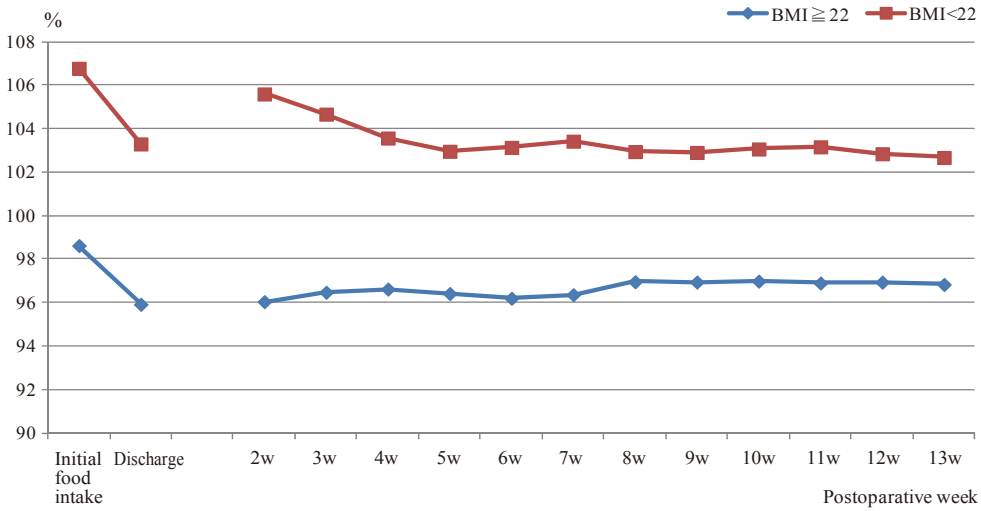

Figure 2. Serial changes in the mean percentage of target weigh

Comparisons between the subgroups of patients with a BMI of ≧22(n=17) and <22 (n=12). The target weight was defined as a weight corresponding to a BMI of 22 for the former group and the preoperative weight for the latter.

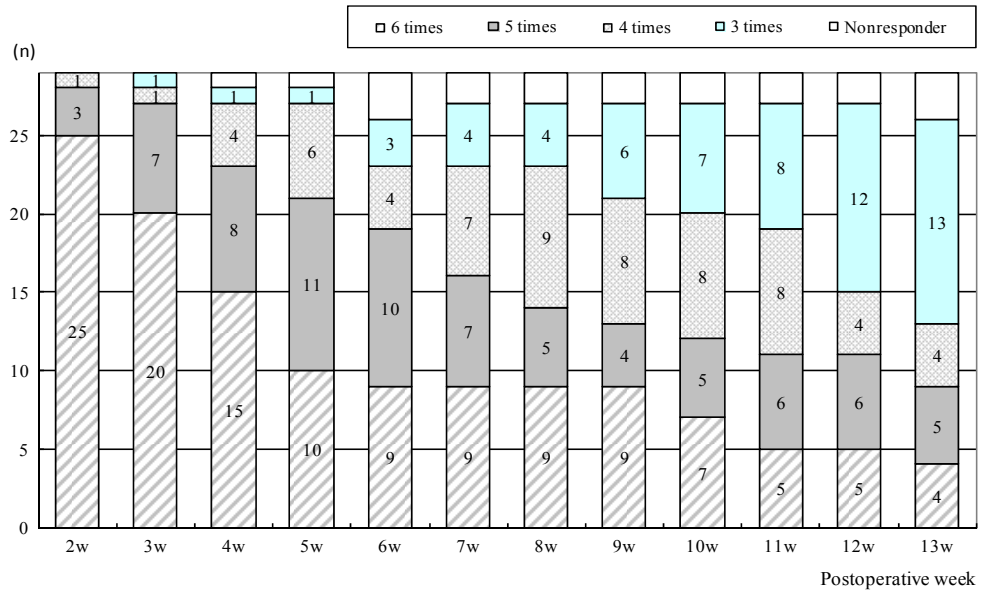

Figure 3. Serial changes in meal frequency

The meal frequency observed on most days of the week was used as the representative value for the week. The nonresponder indicates patients with missing date due to study discontinuation or readmission.

n=26) at postoperative months 1, 2, and 3, respectively.

5. Self-management of food intake

1) Changes in meal frequency after discharge

Serial changes in meal frequency (ranging between 6-3 times/day) by week after surgery are shown as a bar graph in Figure 3.

The percentage of patients having a meal frequency of 6 times/day was 86% (n=25) at postoperative week 2 and gradually decreased to 54% (n=15), 36% (n=10), 26% (n=7), and 19% (n=5) at postoperative weeks 4, 5, 10, and 11, respectively, although meal frequency remained unchanged at 6 times/day in 15% (n=4) of patients even at postoperative week 13.

The percentage of patients having a meal frequency of 5 times/day was 10% (n=3) at postoperative week 2 and gradually increased thereafter to a peak of 39% (n=11) at postoperative week 5, with a subsequent gradual decrease.

The percentage of patients having a meal frequency of 4 times/day was 3% (n=1) at postoperative week 2, and gradually increased thereafter to a peak of 33% (n=9) at postoperative week 8, with a subsequent gradual decrease to 15% (n=4) at postoperative week 12.

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The percentage of patients having a meal frequency of 3 times/day was 3% (n=1) and 12% (n=3) at postoperative weeks 3 and 6, respectively, and gradually increased thereafter to 50% (n=13) at postoperative week 13.

2) Changes in percentage food intake and percentage of target weight after reducing the meal frequency

Using data from the 19 patients who gradually reduced their meal frequency from the initial level of 6 times/day before postoperative week 13, we analyzed the mean food intake and mean percentage food intake during the week of the change in meal frequency (Figure 4).

During the week when these patients reduced their meal frequency to 5, 4, and 3 times/day, they had a mean food intake of 417, 471, and 544 g, respectively, a percentage food intake of 68.0%, 75.5%, and 90.3%, respectively, and a percentage of target weight of 101.5%, 101.9%, and 102.4%, respectively, which demonstrated that the two requirements for reducing the meal frequency of "consuming a meal size of greater than 2/3 of the preoperative size" and "having no weight loss" were met.

3) Postprandial discomfort and diarrhea

Table 2 shows the occurrence of each of the postprandial discomfort symptoms associated with food intake over the total number of days surveyed using the self-administered record form. The most common symptoms that occurred during hospitalization included eructation (29.3%), bloating (13.6%), borborygmus (9.5%), and general heat sensation (8.0%), among which eructation and bloating persisted after discharge to postoperative week 5, and the occurrence of these symptoms decreased thereafter. Although heartburn was less common, its occurrence temporarily increased at postoperative weeks 2 and 3 (3.4% and 3.7%, respectively) and decreased thereafter.

The most common discomfort symptoms reported at postoperative week 13 were bloating (9.5%), eructation (8.0%), abdominal discomfort, and pain (4.4% for both).

The daily frequency of diarrhea exceeded 10% at postoperative weeks 2 and 3, and dropped to 3.6% at postoperative week 13.

Discussion

Despite the major influence of post-discharge dietary self-management practices on the QOL of gastrectomy patients, most medical facilities provide these patients with dietary education that merely introduces general information, but does not focus on increasing their self-management skills to evaluate functional recovery of the remnant stomach and make appropriate decisions regarding their food intake and meal frequency to reduce discomfort. These skills are essential in their daily lives after discharge; therefore, it is desirable for them to learn such skills during hospitalization through a systematic education program. In this study, we evaluated the post-discharge dietary self-management practices and nutritional status of distal gastrectomy patients who had received our in-patient dietary education program, which we had previously developed as a learning system for these patients.

In terms of energy intake, patients who had received the dietary education program had a mean percentage food intake (relative to the mean preoperative food intake of 617.6 ± 122.4 g) of 25.3% at the initiation of food intake and 43.0% at discharge, followed by 60.0%, 71.1%, and 81.6% at postoperative weeks 4, 6, and 9, respectively, and their percentage food intake recovered to 93.8% (564.8 ± 159.3 g) at postoperative week 13. Given previous studies on gastrectomy patients by Liedman et al.[3] estimating endoscopically that the remnant stomach allowed a volume of 410 ml at postoperative month 3, by Hotta et al.[2] demonstrating that patients' food intake recovered to 80% of their preoperative levels at postoperative month 6, and by Wu et al.[16] indicating, based on a questionnaire survey, that patients' food intake did not recover more than 1 year after surgery, it is reasonable to assume that the present results demonstrated favorable outcomes.

In this dietary education program, patients measured their body weight before and after meal ingestion to estimate their food intake from postprandial weight gain, a learning system

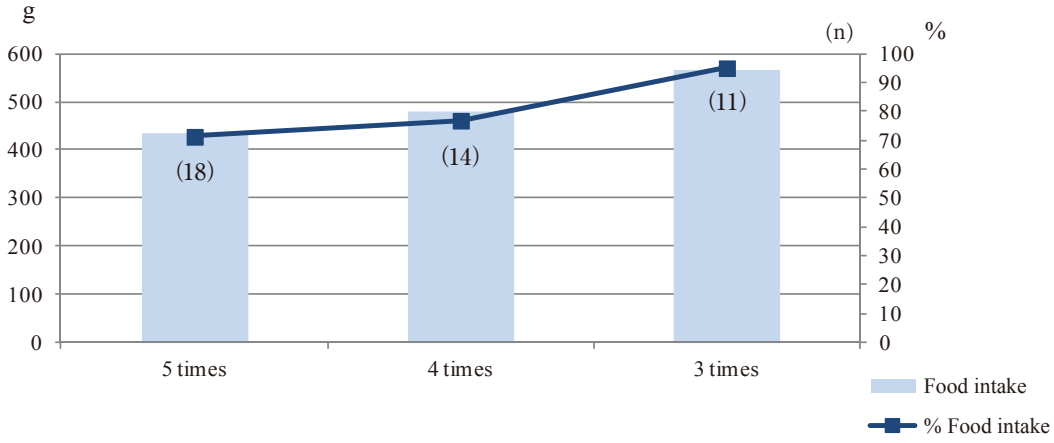

Figure 4. The mean food intake and mean percentage food intake during the week of a change in the meal frequency

The diagram shows the mean food intake and mean percentage food intake of 19 patients who made self-management decisions about meal frequency during the week of a change in the meal frequesncy. The mean food intake (g) is indicated on the left ordinate, the mean percentage food intake is shown on the right ordinate, and meal frequency is given on the abscissa.

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Table 2. Changes in the occurrence of postprandial discomfort and diarrhea

Postoparative week	Symptom items (%)																			Days surveyed
	Eructation	Bloating	Borborygmus	General heat sensation	abdominal discomfort	postprandial diarrhea	Abdominal pain	Palpitations	Nausea	Heartburn	Chest oppression	Cold sweat	Vomiting	General malaise	Fatigue	Drpws omess	Headache	Pallor	Vertogo	Daily diarrhea	
pre-discharge	29.3	13.6	9.5	8.0	4.5	3.7	3.3	2.3	2.0	1.4	1.0	0.9	0.9	0.5							215
2W	33.9	10.2	1.7				1.7			3.4	1.7									10.2	59
3W	30.4	15.5	1.9	0.6	3.7	1.2	5.0		0.6	3.7	1.9	2.5	1.9	1.2						11.8	161
4W	30.6	20.0	0.6		4.7	1.2	2.9		1.8	0.6	1.2	1.2								5.3	170
5W	29.4	11.8	1.2		2.9	2.9	2.9	0.6	1.8	0.6	2.4		0.6			1.2		0.6		4.1	170
6W	21.8	8.8	0.6		2.9	0.6	2.4		1.2	1.2	2.9	0.6	1.2		0.6					5.9	170
7W	18.7	7.6	1.2		2.3		2.9		0.6		1.8			1.8	1.2	0.6	0.6			7.6	171
8W	11.6	5.2			3.5		5.2			0.6	1.2	0.6	0.6	0.6			0.6			2.9	172
9W	11.2	7.1			2.9	1.2	1.2	1.2	0.6	0.6			0.6							6.5	170
10W	17.5	9.0			3.6	1.2	3.0	2.4	1.2	0.6	3.0			1.2		0.6				5.4	166
11W	9.0	8.3			5.1	0.6	4.5		0.6	1.3	1.3			0.6					0.6	6.4	156
12W	10.7	10.7			3.3	0.7	4.0			0.7	0.7	1.3								4.0	150
13W	8.0	9.5			4.4	0.7	4.4	2.2	0.7	0.7		0.7								3.6	137

The value given for each symptom at each time point indicated the occurrence(%) of the symptom over the number of days surveyed. Of the 22 symptom items surveyed, “flushed face” and “fainting” did not occur. “Postprandial diarrhea” indicates diarrhea associated with meal ingestion. “Postprandial diarrhea” was inclued in the calculation for the frequency of “daily diarrhea.”

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designed to provide patients with objective feedback on a daily basis and help them learn how to manage their food intake in relation to discomfort symptoms. By continuing these self-management practices after discharge, patients could increase their skills to self-evaluate the appropriateness of their food intake decisions. Indeed, our patients reported their food intake in terms of gram during post-discharge follow-up visits, which was a positive behavioral change resulting from the program. Although it has been proposed that dietary monitoring of discharged patients requires an independent observer[17], we verified the data collected by patient self-measurement and recording, suggesting that the procedures used in this program could be useful for monitoring food intake.

Regarding energy expenditure, the mean daily physical activity gradually increased from 75.9 kcal at postoperative week 2 to 181.9 kcal at postoperative week 13, during which time the mean daily step counts gradually increased from 3,738 to 7,832 steps, a number that is similar to the average daily step counts of Japanese adults[18], indicating the recovery of these patients. Physical activity and step counts were automatically recorded by the daily activity recorder; therefore, these measurements did not serve as a source of feedback to the patients. Hence, the increase in the mean percentage food intake may reflect these patients appropriately managing their food intake and meal frequency independently of their postoperative physical activity levels.

As for a measure of nutritional status, the mean percentage of preoperative body weight, was maintained at 94.1% at discharge and 93.6% at postoperative week 13. Although the present study reported a greater weight-loss reduction than that of previous studies[5)7)19)20)], weight was only slightly maintained, which was similar to previous findings. In this study, target weight was defined as the weight corresponding to a BMI of 22 for patients with a BMI of ≥22, or the preoperative weight for those with a BMI of <22; weight loss may have occurred in the former subgroup of patients and weight gain may have been promoted in the latter. The mean percentage of target weight in patients with a BMI of ≥22 was 103.3% at discharge and 102.7% at postoperative week 13, showing satisfactory weight maintenance. In patients with a BMI of <22, body weight decreased to 95.9% of their preoperative levels at discharge and was maintained at 96.7% at postoperative week 13. Relative to the age- and sex-specific national average AMC, these patients had a mean percentage AMC of 97.7 ± 9.5% at discharge, showing a subsequent decrease at postoperative month 1 to 94.9 ± 7.5%, which was maintained thereafter. Since similar results were observed for body weight and the AMC, it is assumed that the nutritional status of these patients was maintained for 3 months after surgery; however, the use of dietary supplements may need to be considered as an option for patients with an admission BMI of <22 to improve their nutritional status.

When evaluating self-management practices for food intake and meal frequency, these patients gradually increased their food intake with each postoperative week, with 50% (n=13) of patients reducing their meal frequency to 3 times/day at postoperative week 13. After discharge, during the week when they reduced their meal frequency to 5, 4, and 3 times/day, these patients had a mean percentage food intake of 68.0%, 75.5%, and 90.3%, respectively, and a percentage of target weight of 101.5%, 101.9%, and 102.4%, respectively. Based on the results showing that the two requirements for reducing meal frequency, i.e., "consuming a meal size of greater than 2/3 of the preoperative size" and "having no weight loss," were fulfilled, it is assumed that these patients made appropriate decisions to modify their meal frequency. In this program, patients were instructed to make dietary self-management decisions in relation to epigastric sensations and discomfort. The occurrence of postprandial discomfort decreased after discharge and was below 10% at postoperative week 13, with the frequency of diarrhea decreasing to 3.6%. These results suggest that, despite increased physical activity after discharge, patients maintained their nutritional status through the successful self-management of food intake.

In this study, we demonstrated serial changes in the objective parameters of food intake, post-discharge daily physical activity, and nutritional status (including daily body weight and monthly AMC measurements) of distal gastrectomy patients over a period from hospitalization to 13 weeks postsurgery. These longitudinal quantitative data can be used as basic data, as an alternative to conventional data based on the subjective perceptions of patients. In addition, the present findings indicating that patients who taken part in the in-patient dietary education program appropriately increased their food intake and decreased meal frequency, while maintaining their nutritional status after surgery, suggest their successful self-management practices regarding food intake, in other words, the effectiveness of the dietary education program.

V. Conclusions

To evaluate the post-discharge dietary self-management practices of distal gastrectomy patients who had received an in-patient dietary education program to learn how to self-manage their food intake in relation to recovery of the remnant stomach, we assessed their food intake (a weight gain between before and after having a meal), physical activity (kcal) and step counts using a daily activity recorder, and nutritional status (AMC estimated from skinfold measurements) for three months after surgery. This study included 29 patients and obtained the following results.

1) Measures of energy expenditure: The mean (range) daily physical activity gradually increased from 75.9 (21-330) kcal at postoperative week 2 to 181.9 (33-431) kcal at postoperative week 13, and the mean (range) daily step counts gradually increased from 3,738 (886-16,429) to 7,832 (1,928-16,583) steps during that period.

2) Measure of energy intake: The mean percentage food intake (relative to the mean preoperative food intake of 617.6 ± 122.4 g) was 25.3% at the initiation of food intake, and increased to 43.0% at discharge, followed by 60.0%, 71.1%, and 81.6% at postoperative weeks 4, 6, and 9, respectively, and recovered to 93.8% (564.8 ± 159.3 g) at postoperative week 13.

3) Measures of nutritional status: The mean (range) percentage of preoperative weight was 94.1% (88.4%-101.1%) at discharge and 93.6% (85.3%-102.8%) at postoperative week 13. In patients with an admission BMI of ≥22, for whom the weight corresponding to a BMI of 22 was used as the target weight, the mean percentage of target weight was 103.3% at discharge and 102.7% at postoperative week 13, while in patients with an admission BMI of <22, for whom the preoperative body weight was used as the

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target weight, the relative weight was 95.9% and 96.7%, respectively, at the respective time points. The mean (range) percentage AMC relative to the age- and sex-specific national average was 97.7 ± 9.5% (82.3%-119.1%) at discharge and 94.6 ± 7.9% (79.0%-109.8%) at postoperative month 3.

4) After discharge, during the week when they reduced their meal frequency to 5, 4, and 3 times/day, patients had a mean percentage food intake of 68.0%, 75.5%, and 90.3%, respectively, and a mean percentage of target weight of 101.5%, 101.9%, and 102.4%, respectively, indicating that these patients appropriately reduced their meal frequency.

5) Taken together, independently of increased physical activity after discharge, patients maintained their nutritional status, suggesting their successful self-management practices regarding food intake.

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