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Original Article

Relationship between physical activity and function in elderly patients discharged after surgical treatment for gastrointestinal cancer

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Abstract. [Purpose] The purpose of the present study was to observe changes in physical activity (PA) from before surgery to after discharge among elderly patients with gastrointestinal cancer and to examine the relationships between PA, function, and physique after discharge in these patients. [Subjects and Methods] The study participants were 18 elderly patients who underwent surgical treatment for gastrointestinal cancer [10 males and 8 females, aged 71.4 ± 4.2 years (mean ± SD)]. We evaluated patients' PA, function, and physique before surgery and after discharge. Calorie consumption as calculated using the International Physical Activity Questionnaire (IPAQ) short version was measured for PA. Isometric knee extension force (IKEF), the timed up and go test (TUGT), and the 6-minute walk distance (6MWD) were measured for function. The body mass index (BMI) was calculated for physique. [Results] Significant declines in PA and BMI were observed after discharge among the study participants. In addition, a significant correlation between PA and IKEF was observed in the discharge phase. [Conclusion] These results suggest that PA after discharge is significantly less than that before surgery and related to the functioning of the lower extremities in the same period in elderly patients who undergo surgical treatment for gastrointestinal cancer.

Key words: Elderly patients with gastrointestinal cancer, Physical activity, Function

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INTRODUCTION

Globally, the number of cancer survivors is increasing because of advances in treatment technology and early diagnosis[1)]. In recent years, the outcomes of cancer patients have become important not only in terms of survival rate and life expectancy but also in terms of their quality of life (QOL), i.e., their living conditions after discharge and satisfaction with medical care[2)]. The importance of exercise intervention has been emphasized for improving the QOL of cancer patients[3–8)] and other patients[9–11)].

The maintenance of physical activity (PA) is important for patients' QOL after discharge, and also because it correlates with the survival[12)] and recurrence rates[13)]. A decrease in PA after surgery was reported to be an age-related factor in patients with breast cancer[14)] and prostate cancer[15)]. In this study, we aimed to research the hypothesis that the PA of elderly patients with gastrointestinal cancer decreases after surgery because this age-related factor correlates with a decline in physical function[16)] and an increase in the complication rate[17)] after surgery was tested.

The purpose of the present study was to observe changes in PA, function, and physique from before surgery to after discharge and to examine the relationships between PA, function, and physique before surgery and after discharge in elderly patients with gastrointestinal cancer.

SUBJECTS AND METHODS

The study participants were 29 patients with gastrointestinal cancer who received surgical treatment [19 males and 10 females aged 71.0 ± 3.8 years (mean ± SD)] (Table 1). The purpose of the present study was explained to the patients, who then voluntarily gave their consent to participation. The inclusion criteria were a functional independence measure perfect score before surgery and return to home after discharge from the hospital. The exclusion criteria were the development of postoperative complications, long-term administration of total parenteral nutrition, and bone metastasis. Eleven patients were excluded based on these criteria, leaving a total of 18 patients who completed the study. This study was approved by the ethics committee of the International University of Health and Welfare, Mita Hospital (H23-05). In addition, all the patients in the present

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Table 1. Patient characteristics

		All patients	Control group	Exclusion group
		(n=29)	(n=18)	(n=11)
Age (years)		71.0±3.8	71.4±4.2	70.4±3.2
Gender (n/%)	Males	19/66	10/56	9/82
	Females	10/34	8/44	2/18
Cancer stage (n/%)	I	8/28	5/28	3/27
	II	5/17	2/11	3/27
	III	6/21	5/28	1/9
	IV	10/34	6/33	4/36
Surgical site (n/%)	Stomach	5/17	4/22	1/9
	Liver	9/31	5/28	4/36
	Colon	12/41	7/39	5/45
	Rectum	3/10	2/11	1/9
Surgical procedure (n/%)	Laparoscopic	11/38	9/50	2/18
	Laparotomy	18/62	9/50	9/82
Operation time (min)		255.7±99.3	238.7±66.5	283.5±136.8
Blood loss (ml)		478.1±805.8	306.9±378.2	758.3±1,198.3
C-reactive protein	Before surgery	0.35±0.52	0.34 ±0.60	0.38±0.36
	After discharge	-	1.95±1.43	-
Comorbidity	Hypertension	7/24	5/28	2/18
	Dyslipidemia	1/3	0/0	1/9
	Diabetes Mellitus	3/10	1/6	2/18
	Heart Disease	1/3	1/6	0/0
	Lung Disease	1/3	1/6	0/0
Length of stay (day)		17.4±5.4	15.2±3.5	21.1±6.0
Day of evaluation (POD)	Before surgery	−1.9±1.0	−1.9±1.1	−1.9±0.9
	After discharge	-	9.8±1.7	-

The values of age, operation time, blood loss, C-reactive protein, length of stay and day of evaluation are shown as mean ± standard deviation. Other items are presented as percentages or numbers of cases. POD: postoperative day

study received an aggressive rehabilitation intervention during hospitalization.

The study design was a prospective observational study. We measured the patients' PA, function, and physique. These items were evaluated at two time points: more than 1 day before surgery (before surgery) and after their return home, within 28 days after surgery (after discharge).

PA was assessed using the International Physical Activity Questionnaire (IPAQ) short version[18]. Total PA metabolic equivalents (METs) were calculated using IPAQ data as previously described[18]; the total PA METs was equal to the walking (3.3METs) + moderate PA (4.0METs) + vigorous PA (8.0METs) − minutes / week. The PA value selected in the present study was calorie consumption = total PA METs*3.5(ml/kg/min)*0.005(kcal/ml)*body weight (kg)* 7(days).

Function was evaluated using the isometric knee extension force (IKEF), timed up and go test (TUGT), and 6-minute walk distance (6MWD). IKEF was measured using a hand held dynamometer and was performed on following the evaluation method described in a previous study[19]. The IKEF value was selected as the largest value of two measurements normalized by weight. TUGT was conducted using the original method of Podsiadlo et al[20]. The TUGT value was selected as the smallest value of two measurements. The TUGT measurement was proximal supervised by the physical therapist. 6MWD was measured using a distance meter and was performed on following the stated guidelines of the American Thoracic Society[21]. The 6MWD value selected is the gait distance. In the present study 6MWD was used to establish the discontinuance criteria: unbearable pain at the surgical wound, difficulty in breathing, chest pain, heavy sweating, facial pallor, or emergence of cyanosis.

Physique was evaluated using the body mass index (BMI). BMI was calculated using patients' height and weight while wearing clothes using the equation: BMI = weight (kg)/ height^2 (m^2).

All data were analyzed using IBM SPSS Statistics 21.0 for Windows. The Wilcoxon signed-rank test was used to compare each parameter between the two evaluation points. Spearman's rank correlation coefficient was used to examine the relationship between PA and function (IKEF, TUGT, and 6MWD) and physique (BMI) at the two evaluation times. P values of less than 0.05 were considered to be significant.

Table 2. Long-term changes in each parameter in elderly patients with gastrointestinal cancer

	Evaluation times	
	Before surgery	After discharge
PA (kcal*week)*	3,240.8±6,598.5	1,564.9±2,015.1
IKEF (kgf/kg)	0.51±0.13	0.47±0.13
TUGT (s)	6.37±1.14	6.30±1.48
6MWD (m)	468.1±70.7	467.0±63.8
BMI (kg/m^2)*	21.1±2.4	20.4±2.4

The values of each parameter are shown as the mean ± standard deviation. PA: physical activity; IKEF: isometric knee extension force; TUGT: timed up and go test; 6MWD: 6-minute walk distance; BMI: body mass index. *Wilcoxon signed-rank test

Table 3. Correlation between physical activity and each parameter before surgery

	IKEF	TUGT	6MWD	BMI
PA	−0.104	−0.368	0.307	−0.152

PA: physical activity; IKEF: isometric knee extension force; TUGT: timed up and go test; 6MWD: 6-minute walk distance; BMI: body mass index.

Table 4. Correlation between physical activity and each parameter after discharge

	IKEF	TUGT	6MWD	BMI
PA	0.544*	−0.304	0.100	0.077

PA: physical activity; IKEF: isometric knee extension force; TUGT: timed up and go test; 6MWD: 6-minute walk distance; BMI: body mass index. *Spearman's rank correlation coefficient

RESULTS

The changes in each parameter are shown in Table 2. After discharge, PA and BMI significantly differed from before surgery to after discharge. The correlations between PA and function (IKEF, TUGT, and 6MWD) and physique (BMI) at each evaluation point are shown in Tables 3 and 4. A significant correlation between PA and IKEF was observed after discharge.

DISCUSSION

The PA of elderly patients with gastrointestinal cancer in the perioperative period was found to significantly decline after discharge compared with that before surgery. A previous study reported a negative correlation between PA and age in patients with prostate cancer during the perioperative period[15]. Young patients had better PA than older patients after discharge because many young patients were workers with regular employment. On the other hand, elderly patients showed little improvement in PA compared with young patients, because most did not have regular employment[15]. It is our opinion, the possibility that the decline in PA after discharge is influenced by the employment factors in elderly patients with gastrointestinal cancer during the perioperative phase. Future research is required to compare the PA of young patients to that of elderly patients with gastrointestinal cancer.

In the present study, the PA of elderly patients with gastrointestinal cancer during the perioperative period was significantly related to their function only after discharge. Previous studies have reported that the PA of elderly patients is significantly related to physical function[22, 23] and lower extremity muscle strength[24]. Lower extremity muscle strength is a factor possibly influencing the PA of elderly patients after surgical treatment for gastrointestinal cancer. On the other hand, no significant relationship between PA and function was observed before surgery. A previous study reported that PA is influenced by other social factors[25]. It is our opinion, the possibility that elderly patients with gastrointestinal cancer have more social interactions before surgery than during the recovery period postsurgery.

From the results of the present study, it is our opinion that the necessity to consider lower extremity function of elderly patients with gastrointestinal cancer should be considered before surgical treatment because poor function may continue even after discharge. Further research is required to compare PA between young and elderly patients and to develop rehabilitation interventions to increase patients' PA during hospitalization.

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