



Original Article

Changes in fatigue and physical function with age for patients with gastrointestinal cancer in the perioperative period: a comparison between older and young patients

EISUKE KOGURE, RPT^{1, 2)*}, TSUYOSHI HARA, RPT, PhD³⁾, TAKAYA ISHII, RPT²⁾,
MASAHARU MAEDA, MD¹⁾

¹⁾ Department of Rehabilitation, International University of Health and Welfare Graduate School:
1-3-3 Minami Aoyama, Minato-ku, Tokyo 107-0062, Japan

²⁾ Division of Rehabilitation, International University of Health and Welfare Mita Hospital, Japan

³⁾ Department of Physical Therapy, Faculty of Health Science, International University of Health and Welfare, Japan

Abstract. [Purpose] The purpose of this study was to examine changes in fatigue and physical function with age for groups of patients with gastrointestinal cancer in the perioperative period. [Subjects and Methods] The study involved 52 patients with gastrointestinal cancer (28 males and 24 females, aged 62.4 ± 12.0 years). The subjects were divided into two groups: those 65 or over (the so-called elderly group,) and those 64 or under (the so-called young group). The six minute walk distance (6MWD), Cancer Fatigue Scale (CFS), and serum albumin (ALB) were evaluated on three occasions: before surgery, after surgery and after discharge. This study considered change in physical function and fatigue, differences between the two groups and correlations between age and each evaluation on the three occasions. [Results] The 6MWD was the main difference between the elderly and young groups, with the former having significantly reduced 6MWD values as compared to the latter after surgery. Age was positively correlated with 6MWD and ALB after surgery and after discharge. Moreover, age was negatively correlated with CFS after surgery and after discharge. [Conclusion] It is suggested that elderly patients are more likely to experience a decline in exercise tolerance and an increase in fatigue.

Key words: Patients with gastrointestinal cancer in the perioperative period, Fatigue, Older and young patients

(This article was submitted Jul. 28, 2017, and was accepted Aug. 23, 2017)

INTRODUCTION

Fatigue is a symptom experienced by cancer patients and one of the factors affecting their quality of life (QOL). The National Comprehensive Cancer Network (NCCN) defines cancer-related fatigue (CRF) as “a distressing, persistent, subjective sense of physical, emotional, and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning”¹⁾. Previous studies have shown a prevalence of fatigue of greater than 30% for cancer patients and cancer survivors^{2, 3)}, and greater than 50–80% for advanced and end-of-life cancer patients^{4, 5)}. Improvement in physical function has been reported as decreased fatigue and improved QOL in cancer patients^{6, 7)}. In addition, anxiety, depression and psychological stress have been reported as being correlated with fatigue⁸⁾. Hence, fatigue is associated with physical function and the psychological factors of anxiety and depression.

However, report on the occurrence of fatigue was few studies that after chemotherapy, radiotherapy and lung, prostate,

*Corresponding author. Eisuke Kogure (E-mail: eisuke0590@yahoo.co.jp)

©2017 The Society of Physical Therapy Science. Published by IPEC Inc.



This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives (by-nc-nd) License. (CC-BY-NC-ND 4.0: <https://creativecommons.org/licenses/by-nc-nd/4.0/>)

breast, terminal cancer patients is enough^{9–11}), but gastrointestinal cancer patients is not enough. The study of physical activity and function gastrointestinal cancer patients that cancer incidence rates in Japan accounts for about 45%¹²) was examined preceding study^{13–15}), but fatigue is not enough. The factor of decrease physical activity at before operation with breast and prostate cancer patients were correlated age^{16, 17}), therefore there is a possibility as an elderly patients decrease in physical function and increase fatigue. The purpose of the present study was to examine changes in fatigue and physical function with age for patients with gastrointestinal cancer in the perioperative period, and correlation of age and each evaluation on the three occasions.

SUBJECTS AND METHODS

The study involved 52 patients with gastrointestinal cancer (28 males and 24 females, aged 62.4 ± 12.0 years) from September 2014 to May 2016. The exclusion criteria were as follows: physical and cognitive dysfunction; psychiatric disorders; not independence Activity of Daily Living (ADL), anyone who said that it was impossible of a gait based on the judgment of the doctor in charge; development of postoperative complications. The patient characteristics that were examined were age, gender, stage classification of cancer (cancer stage), operation time, blood loss, and Body Mass Index (BMI). Nutrition status was evaluated using serum albumin (ALB) levels, and inflammation was evaluated using C-reactive protein (CRP).

Fatigue was evaluated using the Cancer Fatigue Scale (CFS)¹⁸), which is correlation of any questionnaire of fatigue. Moreover, it is possible evaluate to conveniently questionnaire of fatigue¹⁹). The CFS consists of three subscales (namely the physical, affective, and cognitive aspect of fatigue) and a 15-item self-rating scale for assessing fatigue in cancer patients. The questionnaire was answered using ratings of 1 (not at all) to 5 (very much).

The maximum total score was 60, with the higher scores indicating. The cut-off score was 19; anything higher indicated severe fatigue that more failure ADL²⁰).

Anxiety and depression were evaluated using the Japanese version of the Hospital Anxiety and Depression Scale (HADS). This consists of a 14-item self-rating scale (assessing anxiety and depression) and is composed of seven-item anxiety and depression subscales. The associated questionnaire was answered in choices of 1 to 4. Total anxiety and depression were calculated as the sum of these aspects (7 points or fewer meant no diagnosis, between 8 and 10 points meant a suspected diagnosis, and 11 points or more meant a certain diagnosis)^{21, 22}).

Physical function was evaluated using the six minute walk distance (6MWD). This was measured using a distance meter and was performed according to the stated guidelines of the American Thoracic Society²³). Evidence presented in a preceding study supports the validity of the 6MWD as a measure of recovery after elective colon resection surgery²⁴). Moreover, the 6MWD was selected to give evaluable evidence of physical function and exercise tolerance.

Each parameter was measured on three occasions (before surgery, after surgery, and after discharge). The subjects of the present study were divided into two groups: those who were 65 years old or over (the so-called elderly group) and those who were 64 years old or under (the so-called young group). The study considered change, differences between the two groups, and correlations between age and each evaluation at each of the three occasions.

The two groups were compared based on age, operation time, blood loss, length of day were used T value test, cancer stage, and surgical site using χ^2 tests. Any p-value of less than 0.05 was considered statistically significant. The data were analyzed using SPSS Statistics 23.0 for Windows. Change of three occasions were used a two-way factorial analysis of variance (ANOVA) (factors: evaluation times and age) and a multiple comparison test (Bonferroni) to compare the studied parameters. Again, and p-value of less than 0.05 was considered statistically significant.

The present study was approved by the ethics committee of the International University of Health and Welfare graduate school (Approval Number: 15-Ig-43).

RESULTS

The characteristics of the subjects are listed in [Table 1](#). No significant were characteristics of subjects. In the multiple-comparison test, 6MWD showed significant differences between the elderly and young groups after discharge, with the young group having a significantly extended 6MWD compared to the elderly group. The CFS was no main effect and interaction between the elderly and young groups, but the elderly group had higher and more dispersed CFS values compared to the young group. The young group were distance extender 6MWD compared to the elderly group at the three measurement occasions. For both groups, the 6MWD was shorter after surgery than before ([Table 2](#)). There were positive correlations between (i) age and 6MWD and (ii) age and ALB after surgery and after discharge. Moreover, age was negatively correlated with CFS after surgery and after discharge ([Table 3](#)).

DISCUSSION

The present study examined fatigue and physical function compared to age (essentially either older or younger than 65) and relationship age and each parameter of patients with gastrointestinal cancer in the perioperative period.

Fatigue was found to be not significant between those over 65 and those 64 or under. In a preceding study, fatigue was

Table 1. Characteristics of patients with gastrointestinal cancer in the perioperative in this study

		All Patients	Elderly group	Young group
Subjects (n)		52	23	29
Age (years)		62.4 ± 12.0	73.2 ± 6.1	53.1 ± 7.8
Gender (n)	Males	18	11	17
	Females	24	12	12
Cancer stage (n)	I	25	9	16
	II	13	7	6
	III	10	6	4
	IV	4	1	3
Surgical site (n)	Stomach	17	8	9
	Pancreas	1	1	0
	Colon	26	10	16
	Rectum	8	4	4
Surgical procedure (n)	Laparoscopic	43	18	25
	Laparotomy	9	5	4
Operation time (minutes)		246.7 ± 73.3	252.2 ± 74.5	242.3 ± 73.5
Blood loss (ml)		156.7 ± 368.9	215.1 ± 454.6	110.4 ± 283.8
Length of stay (day)		13.9 ± 4.9	15.5 ± 4.8	12.7 ± 3.3

The value of age, operation time, blood loss and length of stay are shown as the mean ± standard deviation.

Table 2. Each parameter at three occasions

		Elderly group	Young group
CFS (score)	Before surgery	15 (11, 20)	14 (9, 18)
	After surgery	15 (11, 23)	12 (8, 16)
	After discharge	14 (9, 20)	10 (5, 14)
HADS Anxiety (score)	Before surgery	4 (3, 6)	4 (3, 7)
	After surgery	3 (2, 6)	3 (2, 5)
	After discharge	3 (2, 5)	2 (1, 5)
HADS Depression (score)	Before surgery	5 (2, 7)	3 (1, 6)
	After surgery	3 (1, 6)	2 (1, 5)
	After discharge	4 (1, 7)	2 (1, 4)
BMI (kg/m ²)	Before surgery	22.8 ± 3.6	21.9 ± 3.0
	After surgery	21.7 ± 3.4	20.8 ± 2.8
	After discharge	22.0 ± 3.3	21.1 ± 2.9
ALB(g/dl)	Before surgery	4.3 ± 0.3	4.4 ± 0.3
	After surgery	3.6 ± 0.3	3.8 ± 0.3
	After discharge	4.1 ± 0.3	4.3 ± 0.3
CRP (mg/dl)	Before surgery	0.4 ± 0.9	0.2 ± 0.3
	After surgery	1.8 ± 1.9	1.8 ± 2.0
	After discharge	0.7 ± 2.1	0.2 ± 0.5
6MWD (m)*	Before surgery	530.2 ± 83.9	567.6 ± 112.5
	After surgery	466.3 ± 83.2	519.1 ± 102.8
	After discharge	514.2 ± 81.9	587.7 ± 103.7**

The values of CFS, HADS Anxiety and HADS Depression are shown as the median (25th percentile, 75th percentile)

The values of BMI, ALB, CRP and 6MWD are shown as the mean ± standard deviation.

*A two-way factorial analysis of variance main effect

**Multiple comparison test (Bonferroni)

Table 3. Correlation between age and each parameter at three occasions

		6MWD (m)	CFS (score)	HADS Anxiety (score)	HADS Depression (score)	ALB (g/dl)	CRP (mg/dl)
Age (years)	Before surgery	-0.225	0.062	0.054	0.103	-0.239	0.075
	After surgery	-0.291*	0.353*	-0.023	0.113	-0.351*	0.040
	After discharge	-0.369*	0.293*	0.146	0.190	-0.453*	0.265

*Spearman's rank correlation coefficient

found to be not significant in a comparison between those over 60 and those 59 years old or under at the preoperative stage²⁵). Moreover, fatigue was found to no significant age between patients with high and low fatigue at one-month postoperative²⁶). These findings suggest that comparisons between about 60 and about 65 between high and low fatigue are not significant. However, age was correlated with 6MWD, ALB, and CFS after surgery and after discharge. Hence, it is possible that fatigue and exercise tolerance are related to age. It seems that age and each parameter influence physical activity and the stress of surgery. The elderly group showed a greater decrease in exercise tolerance compared to the young groups. This change in the exercise tolerance of the elderly group was accompanied by an additional decrease in the stress of surgery in the postoperative stage. BMI, operation time, blood loss, CRP, and ALB were no significant main effect and interaction. It seems that elderly and young patients experience infection and the stress of surgery to the same extent. Previous studies showed a significant decline in physical activity for elderly patients with gastrointestinal cancer in the perioperative period after discharge compared to before surgery¹⁵), and a negative correlation between 6MWD and age at three occasions: before surgery, three-weeks postoperative, and six-weeks postoperative²⁴). In addition, previous studies showed negative correlations between age and 6MWD and between age and ALB for elderly patients^{27, 28}). The preceding studies showed negative correlations between age and 6MWD and between age and ALB, similar to previous studies. It was suggested that elderly patients are more likely to experience decreased exercise tolerance and increased fatigue after surgery. Exercise guidance is considered to be important for decreasing fatigue and increasing physical activity after surgery. In this study, changes in fatigue and physical function were found to no significant about 65 years old. However, it was suggested that fatigue and exercise tolerance are related to age.

A limitation of this study was that we did not consider detail of physical activities and physical condition before hospitalization. A future study will be necessary to examine fatigue, QOL, physical and psychological function at before Hospitalization, in addition to relationship between ages.

REFERENCES

- 1) Guidelines Version NC: 1 2014 Cancer-Related-Fatigue. http://www.nccn.org/professionals/physician_gls/f_guidelines.asp (Accessed Jun. 1, 2017)
- 2) Degner LF, Sloan JA: Symptom distress in newly diagnosed ambulatory cancer patients and as a predictor of survival in lung cancer. *J Pain Symptom Manage*, 1995, 10: 423–431. [Medline] [CrossRef]
- 3) Bower JE, Ganz PA, Desmond KA, et al.: Fatigue in breast cancer survivors: occurrence, correlates, and impact on quality of life. *J Clin Oncol*, 2000, 18: 743–753. [Medline] [CrossRef]
- 4) Stone P, Hardy J, Broadley K, et al.: Fatigue in advanced cancer: a prospective controlled cross-sectional study. *Br J Cancer*, 1999, 79: 1479–1486. [Medline] [CrossRef]
- 5) Kutner JS, Kassner CT, Nowels DE: Symptom burden at the end of life: hospice providers' perceptions. *J Pain Symptom Manage*, 2001, 21: 473–480. [Medline] [CrossRef]
- 6) Courneya KS, Mackey JR, Bell GJ, et al.: Randomized controlled trial of exercise training in postmenopausal breast cancer survivors: cardiopulmonary and quality of life outcomes. *J Clin Oncol*, 2003, 21: 1660–1668. [Medline] [CrossRef]
- 7) Cramp F, Daniel J: Exercise for the management of cancer-related fatigue in adults. *Cochrane Database Syst Rev*, 2008, 16: CD006145. [Medline]
- 8) Richardson A: Fatigue in cancer patients: a review of the literature. *Eur J Cancer Care (Engl)*, 1995, 4: 20–32. [Medline] [CrossRef]
- 9) Dimeo F, Fetscher S, Lange W, et al.: Effects of aerobic exercise on the physical performance and incidence of treatment-related complications after high-dose chemotherapy. *Blood*, 1997, 90: 3390–3394. [Medline]
- 10) Segal RJ, Reid RD, Courneya KS, et al.: Resistance exercise in men receiving androgen deprivation therapy for prostate cancer. *J Clin Oncol*, 2003, 21: 1653–1659. [Medline] [CrossRef]
- 11) Segal R, Evans W, Johnson D, et al.: Structured exercise improves physical functioning in women with stages I and II breast cancer: results of a randomized controlled trial. *J Clin Oncol*, 2001, 19: 657–665. [Medline] [CrossRef]
- 12) Hori M, Matsuda T, Shibata A, et al. Japan Cancer Surveillance Research Group: Cancer incidence and incidence rates in Japan in 2009: a study of 32 population-based cancer registries for the Monitoring of Cancer Incidence in Japan (MCIJ) project. *Jpn J Clin Oncol*, 2015, 45: 884–891. [Medline] [CrossRef]
- 13) Hara T, Kubo A, Kogure E, et al.: Impact of the difference in surgical site on the physique in gastrointestinal tract cancer patients. *J Phys Ther Sci*, 2016, 28: 67–71. [Medline] [CrossRef]
- 14) Hara T, Kubo A: The perioperative changes in physical function and physique of patients with gastrointestinal cancer. *J Phys Ther Sci*, 2015, 27: 693–695. [Medline] [CrossRef]
- 15) Hara T, Kubo A: Relationship between physical activity and function in elderly patients discharged after surgical treatment for gastrointestinal cancer. *J Phys Ther Sci*, 2015, 27: 2931–2934. [Medline] [CrossRef]
- 16) Irwin ML, Crumley D, McTiernan A, et al.: Physical activity levels before and after a diagnosis of breast carcinoma: the Health, Eating, Activity, and Lifestyle (HEAL) study. *Cancer*, 2003, 97: 1746–1757. [Medline] [CrossRef]
- 17) Sultan R, Slova D, Thiel B, et al.: Time to return to work and physical activity following open radical retropubic prostatectomy. *J Urol*, 2006, 176: 1420–1423. [Medline] [CrossRef]
- 18) Okuyama T, Akechi T, Kugaya A, et al.: Development and validation of the cancer fatigue scale: a brief, three-dimensional, self-rating scale for assessment of fatigue in cancer patients. *J Pain Symptom Manage*, 2000, 19: 5–14. [Medline] [CrossRef]
- 19) Okuyama T, Wang XS, Akechi T, et al.: Validation study of the Japanese version of the brief fatigue inventory. *J Pain Symptom Manage*, 2003, 25: 106–117. [Medline] [CrossRef]
- 20) Okuyama T, Tanaka K, Akechi T, et al.: Fatigue in ambulatory patients with advanced lung cancer: prevalence, correlated factors, and screening. *J Pain Symp-*

tom Manage, 2001, 22: 554–564. [[Medline](#)] [[CrossRef](#)]

- 21) Higashi A, Yashiro H, Kiyota K, et al.: [Validation of the hospital anxiety and depression scale in a gastro-intestinal clinic]. *Nippon Shokakibyō Gakkai Zasshi*, 1996, 93: 884–892. [[Medline](#)]
- 22) Hiroyuki H, Akane H, Hiroko Y, et al.: A validation of the hospital anxiety and depression scale. *Shinshinigaku*, 1998, 38: 310–315.
- 23) ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories: ATS statement: guidelines for the six-minute walk test. *Am J Respir Crit Care Med*, 2002, 166: 111–117. [[Medline](#)] [[CrossRef](#)]
- 24) Moriello C, Mayo NE, Feldman L, et al.: Validating the six-minute walk test as a measure of recovery after elective colon resection surgery. *Arch Phys Med Rehabil*, 2008, 89: 1083–1089. [[Medline](#)] [[CrossRef](#)]
- 25) Suk H, Kwon OK, Yu W: Preoperative quality of life in patients with gastric cancer. *J Gastric Cancer*, 2015, 15: 121–126. [[Medline](#)] [[CrossRef](#)]
- 26) Jensen MB, Houborg KB, Nørager CB, et al.: Postoperative changes in fatigue, physical function and body composition: an analysis of the amalgamated data from five randomized trials on patients undergoing colorectal surgery. *Colorectal Dis*, 2011, 13: 588–593. [[Medline](#)] [[CrossRef](#)]
- 27) Gomi I, Fukushima H, Shiraki M, et al.: Relationship between serum albumin level and aging in community-dwelling self-supported elderly population. *J Nutr Sci Vitaminol (Tokyo)*, 2007, 53: 37–42. [[Medline](#)] [[CrossRef](#)]
- 28) Troosters T, Gosselink R, Decramer M: Six minute walking distance in healthy elderly subjects. *Eur Respir J*, 1999, 14: 270–274. [[Medline](#)] [[CrossRef](#)]