Impact of the difference in surgical site on the physique in gastrointestinal tract cancer patients

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Abstract. [Purpose] The purpose of the present study was to observe physical function, physique (only BMI), and nutrition status (evaluated by serum albumin levels) from before surgery to after discharge among perioperative patients with gastrointestinal tract cancer and to examine the effect of difference in surgical site (i.e., stomach, colon, and rectum) in these patients. [Subjects and Methods] The study subjects were 70 patients who underwent surgical treatment for gastrointestinal tract cancer [36 males and 34 females, aged 59.3 ± 11.4 years (mean ± SD)]. The subjects were classified into three levels according to surgical site (stomach, colon, and rectum). We evaluated patients’ physical function, physique, and nutrition status in the three points: before surgery, after surgery, and after discharge. The 6-minute walk distance was measured for physical function. Body mass index was measured for physique. The serum albumin level was measured for nutrition status. [Results] Significant declines in 6-minute walk distance, body mass index, and serum albumin were observed after surgery among the study subjects. In addition, a significant decline in body mass index was observed after discharge compared with before surgery. Regarding body mass index, a significant interaction between surgical site and evaluation times was observed for ANOVA. [Conclusion] These results suggest that BMI after discharge is significantly less than that before surgery and that body mass index changes from before surgery to after surgery are efficacy the difference of surgical site in patients who undergo surgical treatment for gastrointestinal tract cancer.

Key words: Difference of surgical site, Patients with gastrointestinal tract cancer, Physique

INTRODUCTION

Globally, the number of cancer survivors is increasing because of advances in treatment technology and early diagnosis1). Recently, the outcomes of cancer patients have become important not only in terms of survival rate and life expectancy but also in terms of the quality of life (QOL), i.e., their living condition after discharge and satisfaction with medical care5). The importance of physical exercise has been emphasized for improving the QOL of patients having cancer3–8) and of those having other diseases9–11).

Patients with gastrointestinal cancer experience differing aftereffects following surgery, depending on the surgical site and extent of resection, which is part of the evaluation of QOL during medical treatment12, 13). In particular, the individual’s physical function and physique influence the decline in dietary intake and decrease in moisture absorption expected after surgery, which are related to the survival rate and life expectancy and are reported to be important factors in maintaining and improving the patient’s QOL during medical treatment14). This means it is important to evaluate changes in physical functioning and physique in perioperative patients with gastrointestinal cancer15). The level of physical function is reportedly...
related to the individual’s type of physique (e.g., skeletal muscle mass)\(^{16}\). The present study hypothesized that physical function, physique, and nutrition status change after surgery and differ between patients by the surgical site in the patient’s gastrointestinal tract. Therefore, the present study aimed to observe the differences in physical function, physique, and nutrition status from before surgery to after discharge in perioperative patients with gastrointestinal tract cancer as well as to examine the effect of different surgical sites in this patient group.

**SUBJECTS AND METHODS**

The present study used a prospective observational study design. In total, 130 patients (69 males and 61 females, mean age 61.5 ± 11.4 years) with gastrointestinal tract cancer who recently underwent surgical treatment participated in the study after providing informed consent (Table 1). The inclusion criteria were as follows: a perfect score on the Functional Independence Measure before surgery and at returning home after discharge from hospital. The exclusion criteria were as follows: the development of postoperative complications, long-term administration of total parenteral nutrition, and bone metastasis. Sixty patients were excluded based on these exclusion criteria, and the remaining 70 patients completed the study. All participants received aggressive rehabilitation interventions during hospitalization. Participants were classified into three categories based on the surgical site (stomach, colon, and rectum). This present study was approved by the ethics committee of International University of Health and Welfare Mita Hospital (H23-05).

We measured participants’ physical function, physique, and nutrition status at three time points: more than 1 day before surgery (before surgery), 10 days after surgery (after surgery), and within 28 days after surgery, after their return home (after discharge).
Physical function was evaluated using the 6-min walk distance (6MWD), which was measured using a distance meter and performed according to the guidelines of the American Thoracic Society. The 6MWD value selected was the gait distance.

We also used the 6MWD to establish discontinuance criteria for the present study: unbearable pain at the site of surgical incision, difficulty in breathing, chest pain, heavy sweating, facial pallor, and emergence of cyanosis.

Physique was evaluated using the body mass index (BMI). BMI was calculated from the participants’ height and weight while clothed, using the following equation: BMI = weight (kg)/height$^2$ (m$^2$).

Nutrition status was evaluated using serum albumin (Alb) levels. Alb was collected from laboratory data at three time points corresponding with the physical function and physique measures.

All data were analyzed using IBM SPSS Statistics 21.0 for Windows (IBM Corp., Armonk, NY, USA). We used a two-way analysis of variance (ANOVA) for the split plot (factors: evaluation times and surgical site) and a multiple comparison test (Bonferroni) to compare the studied parameters. P values of less than 0.05 were considered statistically significant.

**RESULTS**

The changes in each parameter are shown in Tables 2–4. The 6MWD, BMI, and Alb significantly declined after surgery. BMI significantly declined after discharge compared with before surgery. For BMI, ANOVA showed a significant interaction between surgical site and the evaluation times.

**DISCUSSION**

Physical function, physique, and nutrition status of patients with gastrointestinal tract cancer showed a significant decline after surgery. Invasive surgery triggers protein catabolism through the release of amino acid from skeletal muscles throughout
the body accompanied by activation of the immune response\textsuperscript{18}). In addition, in perioperative patients with gastrointestinal cancer, protein catabolism after surgery has been reported to be the greatest on the first day after surgery\textsuperscript{19}. After surgery, in addition to the necessary acute phase rest and dietary restrictions, patients with gastrointestinal cancer experience skeletal muscle atrophy and a decline in physical function associated with metabolic abnormalities. Our findings suggest that a significant decline in the parameters we studied influences these factors. However, we also found that all parameters significantly improved between the second and third time points (after surgery to after discharge). We suggest that it is possible that if the factors influencing these changes are considered (i.e., protein anabolic stage 10 days after surgery)\textsuperscript{19}, dietary intake may be stabilized and physical activity may be increased post discharge.

We found that participants’ physiques were significantly leaner post discharge compared with before surgery. A previous study found that the relationship between a skeletal muscle cross-sectional area and skeletal muscle output was not a linear relationship\textsuperscript{20, 21}, with skeletal muscle output undergoing earlier improvement compared with muscle mass after immobilization\textsuperscript{22}. Our results suggest that perioperative patients with gastrointestinal tract cancer experience a similar phenomenon. In addition, we found that changes in physique from before surgery to post discharge differed based on the site of surgery, with a low average BMI observed in patients who underwent gastrectomy. Gastrectomy patients have been reported to experience a decline in protein intake associated with the extent of resection\textsuperscript{23}. We suggest that the decline in the physique of patients who underwent a gastrectomy may be an effect of the surgical site. However, we also found that gastrectomy patients showed significantly higher levels of C-reactive protein after surgery compared with the other patient groups. Our findings suggest that improvements in the physique of patients with gastrointestinal tract cancer may be delayed by the factors mentioned above.

Our results highlighted that changes in physical function, nutrition status, and physique after surgery are not the same for all patients with gastrointestinal tract cancer. In addition, the differences in changes in physique based on the surgical site may be an indicator reflecting the disease specificity. However, we were not able to objectively evaluate skeletal muscle mass in the present study. Further study is necessary to reexamine the relationship between patient characteristics and an objective evaluation of skeletal muscle mass in perioperative patients with gastrointestinal tract cancer.

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