Effectiveness of the Rehabilitation Program after Colorectal Surgery for Patients with Colorectal Cancer: A Quasi-Experimental Study

Khwanhathai Changyai, Teeranut Harnirattisai, Safiya George Dalmida*

Abstract: An effective rehabilitation program is essential for patients having surgery to regain full physical functions and improve their quality of life. This quasi-experimental study aimed to examine the effectiveness of a rehabilitation program on functional recovery and gastrointestinal quality of life among people with colorectal cancer undergoing surgery. This program was developed using integrated concepts from the Symptom Management Model and Self-Regulation Theory and involved nurse-patient co-operation. Sixty-four participants undergoing colorectal cancer surgery admitted at three tertiary hospitals in Bangkok, Thailand, were recruited into the experimental (n = 32) or control group (n = 32). The experimental group received the Rehabilitation Program after Colorectal Surgery in addition to usual care. The control group received only usual care. The instruments used for data collection were a demographic data record, a Pain Rating Scale, the Abdominal Distension Assessment Scale, the Gastrointestinal Function and Eating Record Form, a Six-Minute Walk Test, a digital spirometer for forced vital capacity, and the Gastrointestinal Quality of Life Index. The outcomes were measured before starting the program, on postoperative days 1 and 3, and two weeks after discharge. Data were analyzed using descriptive statistics, chi-square test, paired t-test, independent t-test, and repeated measures ANOVA.

Results showed that the experimental group had significantly less pain severity and higher functional walking capacity than the control group. For the gastrointestinal quality of life, the experimental group achieved significantly better results in the symptom and physical function domains two weeks after discharge. In conclusion, the Rehabilitation Program after Colorectal Surgery could control symptoms, promote postoperative activities, and enhance recovery and some gastrointestinal quality of life domains. Nurses can use this program to increase functional ability and improve the quality of life among people with colorectal cancer receiving surgery. However, further testing using randomized controlled trials is needed before it can be widely used in practice.

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Introduction

Colorectal cancer is one of the most common digestive system cancers, causing fatality among the world's population. The mortality rate from this

disease is likely to increase in America and Australia, and the colorectal cancer rates in Asia tend to duplicate what happens in other countries.[1] In Thailand, cancer was also the primary cause of death in 2021,[2] and colorectal cancer was ranked first among all cancers found in new cases.[3]

Surgery is considered the main treatment of colorectal cancer. Among the disturbing symptoms after abdominal surgery, pain causes considerable discomfort and delays physical recovery.[4] Furthermore, surgery or general anesthesia possibly causes paralysis of the visceral organs, resulting in bloating and poor digestion.[5] The main goals of postoperative care are to help individuals control postoperative symptoms and promote physical activity, restoring physical function to the highest level.[4]

The expected postoperative functional recovery can be assessed by discharge criteria[6] concerning four primary functional outcomes: pain control, mobilization and self-care ability, tolerance of oral intake, and good physical signs.[7] Apart from the advancement of treatment technology, the quality of life of the patients related to general health and well-being gains more attention from physicians. Though physical activities facilitate gastrointestinal (GI) function, good recovery cannot be fully achieved if people suffer from severe pain limiting body movement.[4]

Previous researchers have developed post-operative rehabilitation programs in different fields of interest to encourage good recovery.[8] However, the outcomes varied across studies. They did not show adequate support for any specific intervention since they could not gain maximum benefits from such programs because postoperative pain considerably limited the patient's movement. Besides pain, insufficient information causes ineffective pain control and ignorance of regular exercise.[9] Patients' false expectations also occur due to poor preparation, leading to psychological problems and inaccurate perception of postoperative pain.[10] The theoretical frameworks cited in the studies were different from one another. One particular theory may not be enough to guide the intervention when problems arise from various sources, such as psychological factors, symptom interference, inadequate preparation, and inefficient measures to increase motivation and collaboration between nurse and patient.

For these reasons, the Rehabilitation Program after Colorectal Surgery (RPCS) involving nurse-patient cooperation was developed using the integrated conceptual framework of the Symptom Management Model and Self-Regulation Theory to promote functional recovery and GI quality of life. Combining two theories to guide the rehabilitation program was expected to be more effective in facilitating sustainable self-care and adherence to exercise, promoting rapid recovery after surgery.

Literature Review and Conceptual Framework

Patients with abdominal surgery, especially colorectal cancer, experience many symptoms, such as pain[4] and abdominal distention[5], which are interrelated and interfere with recovery. Pain limits movement and has consequences such as muscle weakness, fatigue caused by poor sleep, and abdominal distention.[11] To manage these symptoms, the Symptom Management Model proposed by Dodd et al.[12] guided the intervention. The model consists of three interrelated concepts: symptom experience, symptom management strategies, and outcomes, all linked in the simultaneous interaction. A patient knows symptoms, finds a strategy and evaluates the outcome. As a repeating cycle, symptom perception can be redefined in case of changing symptom status, and then re-evaluation will occur to find more suitable management strategies.

Symptom management strategies are derived from both pharmacological and non-pharmacological approaches. The multimodal analgesia method is commonly applied to suppress postoperative pain.[13] Non-drug use approaches were also adopted to alleviate postoperative

symptoms, including acupuncture, massage, deep breathing, relaxation, meditation, and listening to music.[14] To alleviate adverse symptoms, scholars have conducted studies citing Dodd's Symptom Management Model to develop postoperative interventions and nursing care. Prior evidence[15] showed that progressive muscle relaxation, breathing exercises, and foot and leg bending could reduce postoperative pain and promote physical and emotional wellness among people having abdominal surgeries. The techniques of relaxation[16] and meditation[17] in the framework of symptom management theory were also found effective in reducing abdominal distention, relieving undesirable symptoms, and improving GI quality of life. In addition, previous research[18] using Dodd's model exhibited the benefits of education intervention towards walking capacity and pain alleviation among patients having ambulatory inguinal hernia repair, receiving individualized education, informative booklet, and coaching via telephone calls.

However, some studies also reported unsuccessful trials. For example, one study[19] using a psycho-educational intervention of self-study materials and telephone coaching showed non-significant differences regarding pain intensity and interference with function among day surgery patients of the treatment and the control groups and concluded that non-adherence caused ineffective pain control. Analogous findings[20] also proposed that low adherence in frail patients having colorectal cancer resection negatively affects home-based rehabilitation.

Although symptom management is described as intervening factors that will result in better outcomes, the "how" to adhere to and manage those symptom experiences are lacking. Thus, Self-Regulation Theory was used to establish detailed procedures and confirm adherence and sustainability.

Self-regulation[10] enables people to cope with stressful health issues through knowledge preparation, self-observation, and perception evaluation. A person finds their strategies to manage the events and evaluates their satisfaction with the results. These cognitive processes include observing outcomes, monitoring progress, and assessing outcomes, eventually leading to behavioral changes.[21] Emotion regulation, as part of the self-regulation approach, is a construct used to manage or up-down regulate positive and negative emotions, influencing how individuals experience and express emotions behaviorally. This intrinsic and extrinsic process facilitates the achievement of treatment goals.[10]

Several interventions based on self-regulation theory have been developed to facilitate adherence. Meta-analyses[22] regarding the effect of a self-regulatory intervention on medication adherence demonstrated that meaningful activities, including goal setting, self-monitoring, self-reflection, barrier identification and problem-solving, could improve compliance to drug use. Similar findings indicated that self-regulated techniques such as goal setting and action planning, progress monitoring and evaluation could increase commitment to exercise in people with cancer.[23] Also, self-regulation is a practice theory for nurses to find direction for caring and comprehend the link between nursing care and the consequent outcomes.[10] A self-regulated intervention facilitating nurse and patient cooperation in medical treatment decisions could improve the efficacy of the healthcare process and patient adherence.[24]

Though previous studies suggested various principles guiding the development of nursing care, success cannot be guaranteed because adverse postoperative symptoms hindering rehabilitation are not controlled, and deprived self-care awareness and strategies play a vital role in non-adherence. Thus, for this study, Dodd's theory[12] provided insights into symptom management in pre-and postoperative periods. Likewise, Johnson's Self-Regulation Theory[10] supplied constructive and concrete practices for patients to do and adhere to guided activities.

The proposition that guided this study then was derived from Dodd's theoretical construct of symptom management and Johnson's Self-Regulation Theory with the assumption that efficient symptom controls

combined with the promotion of cognitive skills of self-directed behaviors would positively influence functional recovery and quality of life. This proposition serves as the grounding for the hypothesis in this study that postoperative patients receiving the RPCS (experimental group) would experience less pain and abdominal distention, have higher levels of walking capacity and pulmonary function, have a shorter time to return of GI functions and higher GI quality of life than those patients not receiving the program (control group).

Method

Design: This study used a two-group, quasi-experimental design. The Transparent Reporting of Evaluations with Non-randomized Designs (TREND) checklist was utilized as a guideline for this study report.

Setting and Sample: The study settings were the surgical wards of three tertiary care hospitals in Bangkok. The sample was patients with the following criteria: 1) 40 years or over; 2) stage 1-3 of colorectal cancer; 3) receiving their first major surgery; 4) scheduled for colorectal cancer surgery; 5) receiving general anesthesia; 6) oriented to person, place and time; and 7) literate in Thai. Exclusion criteria were: 1) only received colostomy operation; 2) having cognitive (Set Test score ≤ 24) or hearing impairment; 3) having unstable angina or a myocardial infarction one month before evaluation; 4) having severe hypertension; 5) receiving emergency surgery; and 6) being disabled or dependent on walking aids or needing assistance to walk.

Based on previous studies[25,26] and Cohen's formula, the effect size calculation was set at .47. Using the G*Power program, with a power of .80 and alpha .05, the actual sample required was 64, 32 per group. Therefore, the sample for each setting was divided proportionally to size sampling.

Sampling: Participants who met the inclusion criteria were recruited at the surgical ward by convenience sampling. A weekly alternate conducted the experiment and the control group to prevent study contamination. The first week was randomly selected as the intervention group. Thus, all the participants in the first and odd week were in the experimental group, while participants in the second and even week were in the control group until there were 32 in each group.

Ethical Considerations: This study was approved by the Institutional Review Board of Thammasat University (Science) (IRB No. 047/2564, May 10, 2021), and the two studied hospitals (IRB No. 22/64, March 16, 2021, and IRB No. 024/2021, April 8, 2021, respectively). After IRB approval, the primary investigator (PI) clarified the objectives and process of the study, the protection of participants' rights and the right to withdraw from the study at any time with no adverse consequences. Participants were ensured anonymity using number coding. Personal information was kept confidential and securely stored. Finally, the results of the study were presented in general terms.

Instruments: In this study, there were two main outcomes: functional recovery and GI quality of life. Functional recovery referring to overall physical function after surgery was evaluated by examining the following variables: pain control, available walking capacity, pulmonary function, and GI function recovery (the return of GI functions and the condition of abdominal distension observed right after surgery until the presence of symptoms). There were seven instruments applied in data collection, as follows:

A Demographic Data Record developed by the PI was used to collect the participant characteristics, including age, gender, education level, body weight and height and treatment. Such treatment included the cancer stage, surgical procedures, additional treatment, the American Society of Anesthesiologists (ASA) physical status classification (the assessment of patient's fitness prior to surgery), and albumin level.

A Pain Rating Scale was used to measure pain severity. It is one item with an 11-point continuum pain intensity scale, ranging from 0 (no pain) to 10

(the worst pain), on a 10-cm straight line. The higher the score, the more intense the pain experienced. Pain was assessed on postoperative days (POD) 1 and 3.

A 6-Minute Walk Test was used to evaluate functional walking capacity. The participants were asked to walk back and forth along a 15-meter line, and walking distance within six minutes was recorded. A timekeeper was calibrated every time before use. The inter-rater reliability between the research assistant (RA) and the physical therapist in training was .95 before data collection. Walking distance was measured on the admission date, POD 1 and 3, and at two weeks after discharge.

The Gastrointestinal Function and Eating Record Form developed by PI was used in the evaluation of GI function recovery. The GI function and oral feeding were measured in hours, from immediate post-operation to the first time the participants had a passage of flatus, bowel movement, fecal excretion, and return of oral intake (a liquid and a regular diet). In addition, nausea and vomiting were recorded as "yes" or "no" each day postoperative. The participants were asked to record all these data on the record form. The return of GI function was observed during POD 1-7.

The Abdominal Distension Assessment Scale, developed by Munjaiprasert[27] in Thai and adapted by Thamaphan,[28] and was used to evaluate the severity of abdominal distension. It is a visual analog scale (100 mm straight line). Zero (0) means no abdominal distension, and one hundred (100) represents the most severe abdominal distension. The participants were asked to mark on the scale matching their feelings of distension. The obtained scores were grouped into three thresholds: no symptom was 0, low severity (1-40) was 1, moderate severity (41-60) was 2, and high severity (61-100) was 3. Abdominal distension was assessed on POD 1 and 3.

A digital spirometer (CONTEC SP70B) was used to examine cough expiratory flow and determine forced vital capacity (FVC). This instrument was always calibrated before use. The inter-rater reliability between the RA and the expert in training was .98 before the data collection. FVC was measured on the admission date, POD 1 and 3, and at two weeks after discharge.

The Gastrointestinal Quality of Life Index (GIQLI) was developed by Eypasch et al.[29] (English and German versions) and, according to the owner's criteria, Mapi Research Trust was translated into Thai by following linguistic validation guidance of a clinical outcome assessment (COA) (personal communication with Mapi Research Trust on June 26, 2020). The translation process was forward and backward, tested with potential participants, and proofread. The bilingual translators met the criteria as required by the owner, and translation approval was granted from the Mapi Research Trust. The Index includes 36 items, grouped into five domains: symptoms (19 items); physical functions (7 items); emotions (5 items); social functions (4 items); and medical treatment (1 item). The GIQLI is scored on a 5-point Likert scale, ranging from 0 (all the time) to 4 (never) (e.g., "*Over the past two weeks, how often have you had abdominal pains?*").[29] The total scores range from 0-144; a higher score indicates a higher GI quality of life. It was reviewed by three experts (two surgeons and one clinical nurse specialist). In this study, CVI was 1.00. Then, the questionnaire was pilot-tested with 30 participants who met the same criteria as the participants in the main study. Cronbach's alpha coefficient was .83 for the pilot sample and .92 for the main study. GI quality of life was obtained on admission and two weeks after hospital discharge.

Rehabilitation Program after Colorectal Surgery (RPCS):

As mentioned, the RPCS was developed based on the theoretical frameworks of Symptom Management Model[12] and Self-Regulation Theory[10] to promote postoperative rehabilitation. This program started at least one day before surgery, extended to postoperative periods and discharge, and ended at the first follow-up. It consists of three parts: 1) encouraging the ability to

perceive and manage symptoms; 2) promoting strategies for symptom management and performance in activity regulation; and 3) monitoring and evaluating physical activities for improvement. The program was implemented approximately three weeks after enrollment. Each session lasted 20-60 minutes. First, the RPCS was reviewed by the same instrument experts and revised according to their suggestions. Then the program was pilot tested to evaluate its practicability. Details of implementations of the RPCS are shown in **Table 1.**

Table 1. Rehabilitation Program after Colorectal Surgery (RPCS)

Program components Periods/Duration	Objectives	Theories	Nursing activities	Materials
1. Encouraging the ability to perceive and manage symptoms				
- Basic knowledge preparation (Admission date: 30 minutes)	-To give knowledge and make patients aware of the advantages of postoperative rehabilitation	SMT: Symptom management strategies SRT: Information provision	- Teaching self-care techniques before and after surgery - Introducing patients to progressive muscle relaxation techniques, stretching, core exercise, rubber band exercise, breathing exercise, and effective cough by using PowerPoint Presentation (PPT) - Distributing informative booklets about pre-postoperative self-care and exercising activities during hospitalization and after discharge	- PPT - Handbook
- Assessed perceived experience of the symptoms (Admission date : 10 minutes)	-To investigate the patient's perception in anticipation of the upcoming operation (Data will facilitate an instructional scheme aimed at promoting better insights)	SMT: Symptom experience	- Evaluating the awareness of the imminent symptoms and the management strategies via discussion - Accessing perceived symptom experiences and using the interview and inquiry, for example: 1) Have you ever been seriously sick or injured? What symptoms did you experience? How did you cope with such symptoms? 2) What postoperative symptoms do you expect to experience? 3) What method will you use to manage the unwanted symptoms? - Providing precise information about the symptoms and condition after surgery	- PPT
2. Promoting strategies for symptom management and performance in activity regulation				
- Skill training in symptom management and regulating rehabilitation activities (Admission date : 10 minutes)	- To equip patients with skills essential for pain management and physical rehabilitation after surgery	SMT: Symptom management strategies	- Training progressive muscle relaxation techniques and physical activities using video clips - Practicing body movement postures and exercises through demonstrative teaching and practicing - Evaluating needed skills	- Video clips

Table 1. Rehabilitation Program after Colorectal Surgery (RPCS) (Cont.)

Program components Periods/Duration	Objectives	Theories	Nursing activities	Materials
- Developing the capability of a self-regulation technique (Admission date : 10 minutes)	-To get patients well-educated about self-regulation principles and more confident in performing targeted activities	SMT: Symptom management strategies SRT: Goal setting	- Educating patients about self-regulation techniques: goal setting, self-observation, self-judgment, and self-reaction through PPT - Having patients formulate exercise goals - Planning daily exercises and writing action plan on provided handbook	- PPT - Handbook
-Regular performance progressive muscle relaxation techniques (POD 1-5: 20 minutes twice/day) physical activities (POD1-D/C :30 minutes twice/day)	-To let patients implement pain management techniques and relaxation techniques to cope with the symptoms -To have patients perform physical activities	SMT: Symptom management strategies	- Practicing progressive muscle relaxation techniques and physical activities (breathing exercises, effective cough, stretching, early mobilization, core exercises, and resistance exercises), gradually increasing the intensity - Monitoring patients' progress - Checking performance and the implementation of symptom management strategy by asking: 1) Did you sit up on the bed? Did you turn your body? 2) Did you perform stretching or use the rubber band? 3) How many times can you raise your legs?	- Rubber band
-Self-monitoring	- To promote adherence to activities	SRT: Self-observation	- Observing/monitoring self-performance (recording daily exercise activities): • Recording exercise activities on a daily log • Examining patients' record and exercising progress • Encouraging self-monitoring by asking patients to keep recording daily performance	- Daily log (provided in the handbook)
-Self-evaluations (POD 1, 3, and 5 :10 minutes)	-To promote self-judgement and behavioral changes to achieve the targets	SRT: Self-judgement	- Making self-evaluations/judgments in exercising the ability - Comparing daily results to the set goals (goals can be adjustable) - Having patients evaluate their exercise performance compared to the set goals • Identifying problems and giving solutions • Adjusting plans and setting realistic goals (nurse-patient decision-making)	- Daily log (provided in the handbook)
-Self-satisfaction (POD 1, 3, and 5: 10 minutes)	-To increase motivation and maintain sustainability	SRT: Self-reaction	- Empowering self-confidence and self-satisfaction when goals are achieved: • Verbal reinforcement to increase motivation • Eliciting feedback or problems related to exercising • Promoting patients' self-reflection about supportive factors and rewards from the exercising	-

Table 1. Rehabilitation Program after Colorectal Surgery (RPCS) (Cont.)

Program components Periods/Duration	Objectives	Theories	Nursing activities	Materials
- Evaluation (POD 1 and 3: 5 minutes)	-To get information about the patient's symptom	SMT: Outcomes	- Evaluating the levels of symptoms after the delivery of the program: • Having the patient evaluate the symptoms by using a Pain Rating Scale and the Abdominal Distension Assessment Scale • Encouraging patients to record their GI Function and Eating Record Form and examine the record - Testing walking capacity and pulmonary function by using 6MWT and spirometer, respectively and recording the outcomes on the printed sheet	- A Pain Rating Scale - The Abdominal Distension Assessment Scale - The GI Function and Eating Record Form - The Functional Walking Capacity and Pulmonary Function Sheet - Spirometer
-providing information about being discharged (Date of discharge: 20 minutes)	-To make patients well-prepared and have sufficient information before discharge	SMT: Symptom management strategies	- Focusing patients on constant exercising, diet consumption, quality of sleep, and symptom observation • Teaching about self-care, wound care, and dieting after discharge by using PPT • Encouraging patients to perform physical activities at home	- PPT - Handbook
3. Monitoring and evaluating of physical activities for improvement				
-Telephone follow-up (1 week after discharge: 15 minutes)	-To remind patients of the intervention and help them solve the problems	SRT: Self-observation, Self-judgement, Self-reaction	- Asking patients about the obstacles when returning home (follow-up call once a week) • Raising motivation and reinforcement through a telephone call • Reviewing knowledge to maintain assigned activities • Giving advice and problem-solving through telephone counseling • Encouraging patients to perform exercising, monitor progress, and record daily performance	
- Evaluation (2 weeks after discharge: 10 minutes)	-To assess overall improvement	SMT: Outcomes	- Testing walking capacity and pulmonary function by using 6MWT and spirometer, respectively - Evaluating GI quality of life by using the questionnaire	- GIQLI - The Functional Walking Capacity and Pulmonary Function Sheet

Note: SMT=Symptom Management Theory, SRT = Self- Regulation Theory

Usual care: This was a set of standard nursing care provided by nurses at each surgical ward, including physical examination, health education regarding essential self-care, early ambulation and discharge planning consisting of drug use, wound care, medical equipment uses (colostomy bag), and medical appointment, which was similar among the three hospitals.

Data Collection: This study was conducted from May 2021-February 2022, within each hospital's standard protocol for the COVID-19 pandemic. After the IRB approval, the PI contacted the head nurse of the three hospitals to inform research objectives and procedures. The ward nurses were asked to recruit potential participants according to the inclusion criteria. Then the PI met them, notified details of the study, and asked them to sign consent forms. The RPCS was delivered to the experimental group by the PI. Data were collected by three research assistants (RAs) in each setting who were registered nurses with more than 3-year experience taking care of surgical patients and currently working in a surgical ward. They were informed about the research objectives and trained in data collection procedures. Also, they facilitated the PI to take care of patients while practicing activities and were unaware of the group assignment. The experimental group received the RPCS and usual care, whereas the control group received only usual care.

Data Analysis: This was conducted using the SPSS program version 22.0. The Shapiro-Wilk test was used to determine the normality of the numerical variables. Personal demographic data were analyzed using descriptive statistics. The chi-square and independent t-test were used to examine the differences in sample characteristics between the groups.

Before analysis, the assumption of the independent t-test and paired t-test, including normality distribution and homogeneity of variance, were tested. Thus, independent t-tests were used to analyze the differences between groups regarding postoperative pain scores, time to return of GI function, and GIQLI scores. A paired t-test was used to analyze the differences in pain and GIQLI scores within the group.

Since the distribution of abdominal distention scores was non-normality, showing positive skewness. The chi-square test was used to compare the frequency and percentage of patients having abdominal distension between the groups. In addition, the chi-square test was also used to compare the number of participants with postoperative nausea and vomiting between the groups.

Repeated measures ANOVA were employed to test the differences in functional walking capacity and pulmonary function between groups and within groups across the three periods. The Shapiro-Wilk statistical test showed normality distribution. Also, compound symmetry was checked by Mauchly's test of sphericity. Finally, Bonferroni tests were used for post-hoc multiple pairwise comparisons between each time point. The statistical significance level was set at .05.

Results

Characteristics of participants and medical history

The total participants (100%) remained in the study until the end. Among the total population (n = 64), 59.3% were male, and 40.7% were female. The mean age was 63.22 (SD = 10.57). Cancer was mainly found in the rectum (54.6%), and most participants (46.9) had stage 3 cancer; 56.2% received laparoscopy, and 43.8% received open abdominal surgery. At baseline, demographic characteristics, as well as medical history between the two groups, were not significantly different. **(Table 2).**

Effectiveness of RPCS on functional recovery

When comparing POD 1 and 3, both groups' mean pain scores significantly decreased. Comparing between groups, the mean pain scores of the experimental group were considerably less than those of the control group on POD 1 and 3 (**Table 3**).

Table 2. Personal demographic data

Characteristics		Frequency (%)			Statistic value	p-value
		Total (N = 64)	Experimental group (n = 32)	Control group (n = 32)		
Gender					.000[a]	1.000
Male		38 (59.3)	19 (59.3)	19 (59.3)		
Female		26 (40.7)	13 (40.7)	13 (40.7)		
Age (years)	Mean (SD)	63.22 (10.57)	63.53 (11.04)	62.91(10.23)	.235[b]	.815
	range	40-85	45-85	40-81		
40-59		18 (28.1)	9 (28.1)	9 (28.1)		
60-79		43 (67.2)	21 (65.6)	22 (68.8)		
80 and above		3 (4.7)	2 (6.3)	1 (3.1)		
Education					8.640[a]	.220
Elementary level		20 (31.1)	9 (28.1)	11 (34.4)		
Secondary school		4 (6.3)	2 (6.3)	2 (6.3)		
Senior high school		13 (20.3)	6 (18.7)	7 (21.8)		
Vocational certificate		7 (11.0)	5 (15.7)	2 (6.3)		
Diploma		4 (6.3)	4 (12.5)	-		
Undergraduate degree		13 (20.3)	6 (18.7)	7 (21.8)		
Postgraduate degree		3 (4.7)	-	3 (9.4)		
Comorbidity					.075[a]	.784
Yes		45 (70.3)	22 (68.8)	23 (71.9)		
No		19 (29.7)	10 (31.2)	9 (28.1)		
Albumin level	Mean (SD)	4.01 (.47)	4.11(.44)	3.92 (.48)	1.686[b]	.097
(gm/dL)	range	2.8-4.9	3.3-4.9	2.8-4.7		
less than 3.5 gm/dL		9 (14.0)	2 (6.3)	7 (21.8)		
3.5-5 gm/dL		55 (86.0)	30 (93.7)	25 (78.2)		
Body mass index	Mean (SD)	23.81 (4.07)	23.60 (3.78)	24.01 (4.40)	-.396[b]	.694
(kg/m^2)	range	16-37.22	16.85-36.11	16-37.22		
underweight		4 (6.3)	2 (6.3)	2 (6.3)		
normal		26 (40.7)	13 (40.7)	13 (40.7)		
overweight		34 (53.0)	17 (53.0)	17 (53.0)		
ASA classification					1.565[a]	.457
class 1		1 (1.5)	-	1 (3.1)		
class 2		44 (68.8)	21 (65.6)	23 (71.9)		
class 3		19 (29.7)	11 (34.4)	8 (25.0)		
Cancer sites					4.562[a]	.871
Ascending colon		7 (11.0)	4 (12.5)	3 (9.4)		
Transverse colon		2 (3.1)	2 (6.3)	-		
Descending colon		4 (6.3)	2 (6.3)	2 (6.3)		
Sigmoid colon		14 (21.9)	6 (18.7)	8 (25.0)		
Rectum		35 (54.6)	18 (56.2)	17 (53.0)		
> 1 site		2 (3.1)	-	2 (6.3)		
Stages of cancer					.515[a]	.773
stage 1		12 (18.8)	7 (21.8)	5 (15.7)		
stage 2		22 (34.3)	10 (31.2)	12 (37.3)		
stage 3		30 (46.9)	15 (47.0)	15 (47.0)		
Concomitant adjuvant therapy					1.036[a]	.309
not treated		38 (59.3)	21 (65.6)	17 (53.0)		
treated		26 (40.7)	11 (34.4)	15 (47.0)		

Table 2. Personal demographic data (Cont.)

Characteristics	Frequency (%)			Statistic value	p-value
	Total (N = 64)	Experimental group (n = 32)	Control group (n = 32)		
Types of Surgery				.000[a]	1.00
open surgery	28 (43.8)	14 (43.8)	14 (43.8)		
laparoscopic surgery	36 (56.2)	18 (56.2)	18 (56.2)		

[a] Chi-square, [b] Independent t-test, ASA = American Society of Anesthesiologists

Table 3. Means of pain scores by time by a group

Group	T1	T2	Paired t-test
	Mean (SD)	Mean (SD)	
EG (n = 32)	3.06 (1.98)	2.19 (1.99)	1.852 p-value = .037
CG (n = 32)	4.50 (2.68)	3.56 (2.59)	2.048 p-value = .025
Independent t-test	-2.442 p-value = .009	-2.381 p-value = .010	

EG = Experimental group, CG = Control group

T1 = Postoperative day1, T2 = Postoperative day3

The mean functional walking capacity scores in the experimental group were significantly higher than in the control group. However, there was no interaction effect of the group and time. Post-hoc pairwise comparisons indicated that, in both groups, mean functional walking capacity scores increased significantly in each measurement, between T1 and T2, T1 and T3, and T2 and T3 (**Table 4**).

Table 4. Repeated measures of ANOVA and multiple pairwise comparisons of functional walking capacity and pulmonary function

Variables	Repeated measures ANOVA						Group	Multiple pairwise comparisons (Bonferroni method)		
	Group		Time		Group* Time			T1 vs. T2	T1 vs. T3	T2 vs. T3
	F	p-value	F	p-value	F	p-value				
Functional walking capacity	9.63	.003	312.78	.000	2.37	.107	EG (n = 32)	-63.13***	-203.85***	-140.72***
							CG (n = 32)	-81.54***	-243.57***	-162.03***
Pulmonary function	.35	.56	117.78	.000	1.96	.149	EG (n = 32)	-.45***	-.93***	-.48***
							CG (n = 32)	-.23**	-.80***	-.57***

EG = Experimental group, CG = Control group

T1 = Postoperative day1, T2 = Postoperative day3, T3 = 2 weeks after hospital discharge

** p < .01, *** p < .001

The pulmonary function scores of the experimental group were not significantly higher than those of the control group. However, there was a significant change in the scores over time. It was also noted that there was no interaction between time and groups. Post-hoc pairwise comparisons indicated that, in both groups, pulmonary function scores increased significantly in each measurement between T1 and T2, T1 and T3, and T2 and T3. Similar findings were found in the control group (**Table 4**).

Regarding GI function, after the intervention, only the durations of the first oral fluid and food intake of the experimental group were significantly shorter than those of the control group. However, the duration of the first time of the experimental group's flatulence, fecal excretion, and bowel recovery was shorter than those of the control group, but there were no statistically significant differences. In addition, the number of participants having abdominal distension, nausea and or vomiting in the experimental group was not significantly different from that of the control group in each measurement (**Table 5**).

Table 5. The return of GI function and the presence of adverse symptoms

Variables	EG (n = 32)	CG (n = 32)	t	p-value
	Mean (SD)	Mean (SD)		
Time to return to gastrointestinal function (hrs.)				
Time to bowel movement	34.81 (19.60)	43.58 (31.37)	-1.341	.092
Time to flatus	43.39 (23.60)	45.50 (27.95)	-.326	.373
Time to oral fluid intake	50.87 (21.81)	65.20 (30.41)	-2.166	.017
Time to oral food intake	93.38 (28.70)	108.10 (36.81)	-1.784	.039
Time to feces excretion	69.21 (38.57)	69.30 (37.79)	-.009	.497
Abdominal distention	**Frequency (%)**	**Frequency (%)**	χ^2	**p-value**
POD1			1.665	.645
No symptom	23 (71.9)	21 (65.6)		
Low severity	5 (15.6)	4 (12.5)		
Moderate severity	3 (9.4)	4 (12.5)		
High severity	1 (3.1)	3 (9.4)		
POD3			3.038	.386
No symptom	22 (68.8)	17 (53.1)		
Low severity	7 (21.8)	9 (28.1)		
Moderate severity	3 (9.4)	4 (12.5)		
High severity	-	2 (6.3)		
Nausea and or vomiting	**Frequency (%)**	**Frequency (%)**	χ^2	**p-value**
POD1			1.410	.703
No	25 (78.2)	27 (84.3)		
Yes	7 (21.8)	5 (15.7)		
POD2			.986	.611
No	24 (75)	27 (84.3)		
Yes	8 (25)	5 (15.7)		
POD3			2.074	.557
No	28 (87.5)	26 (81.3)		
Yes	4 (12.5)	6 (18.7)		
POD4			4.074	.396
No	29 (90.6)	29 (90.6)		
Yes	3 (9.4)	3 (9.4)		
POD5			2.980	.225
No	32 (100)	30 (93.7)		
Yes	-	2 (6.3)		

POD = postoperative day

Effectiveness of RPCS on GI quality of life

As shown in **Table 6**, before the program's implementation, there were no statistical differences in the mean scores between the control and experimental groups on overall GIQLI. However, after completing the program, the experimental group had a significantly higher mean score of overall GI quality of life in the symptom domain and physical function than did the control group. In contrast, the other domains were not significantly different.

Table 6. Mean scores of GI quality of life by time and by group

Variables	Group	M (SD)		Pretest-Posttest		Pretest		Posttest	
		T0	T3	t^a	p-value	t^b	p-value	t^c	p-value
GI quality of life (5 domains)									
symptom	EG	62.41 (8.78)	64.72 (7.66)	-1.692	.005	.826	.412	1.805	.038
	CG	60.38 (10.78)	61.16 (8.12)	-.429	.336				
emotion	EG	14.72 (4.04)	15.47 (4.12)	-.866	.196	-.606	.546	1.070	.145
	CG	15.34 (4.20)	14.47 (3.25)	.853	.200				
physical function	EG	19.44 (5.93)	19.84 (4.68)	-.379	.353	.695	.490	2.020	.024
	CG	18.34 (6.65)	17.31 (5.32)	.747	.231				
social function	EG	12.44 (3.15)	11.31 (3.12)	3.044	.003	-.321	.749	.977	.166
	CG	12.69 (3.07)	10.59 (2.70)	6.157	.000				
medical treatment	EG	3.25 (1.02)	2.56 (1.39)	2.871	.004	.116	.908	-.278	.391
	CG	3.22 (1.13)	2.66 (1.31)	2.252	.016				
Total score	**EG**	**111.75 (20.99)**	**114.78 (16.92)**	**-.863**	**.198**	**.358**	**.721**	**2.100**	**.020**
	CG	**109.88 (20.89)**	**106.13 (16.04)**	**1.036**	**.154**				

EG = Experimental group, CG = Control group

T0 = Before starting the program, T3 = 2 weeks after hospital discharge

t^a = Paired t-test (comparison between pretest and posttest)

t^b = Independent t-test (comparison between the two groups before starting the program)

t^c = Independent t-test (comparison between the two groups two weeks after hospital discharge)

Discussion

The findings of this study indicated that the RPCS developed based on the Symptom Management Model and Self-Regulation Theory could enhance functional recovery and overall GI quality of life and two domains of symptom and physical function.

The RPCS program could significantly decrease pain in the intervention groups regarding postoperative pain, and this was because the experimental group was educated about pain control and exercising during preoperative preparation. Owing to progressive muscle relaxation, postoperative pain could be lessened. The recommended progressive muscle relaxation causes cognitive changes and inhibits the transmission of signals to nerve fibers, reducing pain sensation.[30] Regular exercising also reduces pain and relevant symptoms since it increases ventilation and the amount of oxygen in the body.[31]

Concerning physical function, the walking distance of the experimental group significantly increased across the periods and was also more than that of the control group. By virtue of symptom management and self-regulation strategies introduced through skill training and education during hospitalization, the patients could effectively manage adverse symptoms and perform physical activities. A similar study on pain intervention, including pain and health education, also reported positive outcomes of pain management and early ambulation.[32] Functional walking capacity can be improved by doing different activities. The resistance band exercise, for example, promoted muscle strength, balance, and movement.[33] In addition to pain control, self-regulated activities such as daily records kept patients exercising, leading to physical improvement.[23]

For pulmonary function, the experimental group had significant improvement in pulmonary function at each measuring point. However, there was no significant difference between the groups, probably because, as a treatment protocol, some hospitals provided a Triflow incentive breathing spirometer to all patients. The control group may gain some benefits from the device. A similar finding[34] showed no significant difference between the groups as both received an incentive spirometer. The researchers concluded that more activities to increase lung capacity should be included in the intervention.

Considering the time to return of GI function, data showed significant outcomes regarding early oral feeding. The intervention group started oral fluid and food intake faster than the control group. Reasons can be given that early ambulation, aided by effective pain control, triggered intestinal organs to function.[35] Performing the core abdominal exercise marked in the program could stimulate peristalsis of the digestive tract.[36] However, there were no significant differences between the groups concerning the duration of the first bowel movement, time to first flatulence, and fecal excretion time. It may be because 57.9% of the participants in this study received an ostomy after the operation. In this case, flatulence and excretion were beyond mind control and awareness.[37] As reported by most participants, they did not remember the exact time of flatulence and excretion. Data for abdominal distension, nausea and vomiting showed no difference between the groups. It is noted that participants of both groups were also advised to keep moving by healthcare providers and family members to prevent abdominal discomfort and influence the patient's desire to achieve postoperative recovery.[38]

The RPCS could increase overall GI quality of life and domain of symptom and physical function. Since the program helped the patients control undesirable symptoms, it could improve physical function. In view of Self-Regulation Theory, this program offers self-monitoring and evaluation techniques involving nurse-patients cooperation. It could increase motivation, bring about behavioral changes and solid outcomes, and secure adherence to activity. A similar study[23] also confirmed that the self-regulatory programs enabling nurse-patient collaboration supported physical activity maintenance, exercise motivation, and physical fitness among people with cancer.

However, scores were reduced in two domains of GI quality of life: social function and medical treatment. Data also showed no significant difference regarding the two domains compared to the control group. The reason is that the study period may be insufficient for vulnerable patients to recover fully. The GI quality of life was assessed two weeks after discharge, considered a relatively short period. Still, the participants experienced weakness and fatigue, so there were no drastic changes according to the medical treatment. Another reason is relevant to the pandemic-driven health policy. This study was conducted during the first wave of the COVID-19 outbreak, social distancing was guided, and there was much fear and worriedness about the infection, so people isolated themselves, avoiding social interaction.[39]

Limitations

The findings of this study are limited in generalizability since participants were only from three tertiary care hospitals in Bangkok, so the results may not be applied to other settings. In addition, patients were not randomized to experimental or control groups, but they were assigned by week through clusters randomly. The different situations caused by cluster random in the hospital setting may affect the internal validity of this study.

Conclusions and Implications for Nursing Practice

The findings of our study support the hypotheses of this study, and the theoretical proposition derived from combining theoretical constructs from both frameworks used in this study. The results confirmed the effectiveness of symptom management strategies

to expedite functional recovery and increase GI quality of life. Therefore, Dodd's[12] and Johnson's[10] theories complemented each other and can be used together to make nursing care more efficient. Nurses can use the RPCS to expedite the recovery from colorectal or other abdominal surgery with further testing using randomized controlled trials. Also, the program should be standardized with innovative technology, such as with applications for preoperative teaching. However, reinforcing activities as outlined in the program are still needed after operations.

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ผลของโปรแกรมการฟื้นฟูสมรรถภาพภายหลังการผ่าตัดลำไส้ใหญ่และทวารหนักในผู้ป่วยมะเร็งลำไส้ใหญ่และทวารหนัก: การศึกษากึ่งทดลอง

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บทคัดย่อ: โปรแกรมการฟื้นฟูสมรรถภาพที่มีประสิทธิภาพเป็นสิ่งจำเป็นสำหรับผู้ป่วยที่ได้รับการผ่าตัดเพื่อให้ร่างกายกลับคืนสู่การทำหน้าที่ได้อย่างสมบูรณ์และส่งเสริมคุณภาพชีวิตของผู้ป่วย การศึกษากึ่งทดลองนี้มีวัตถุประสงค์เพื่อศึกษาผลของโปรแกรมการฟื้นฟูสภาพต่อการฟื้นตัวด้านการทำหน้าที่และคุณภาพชีวิตของทางเดินอาหารในผู้ป่วยที่เข้ารับการผ่าตัดมะเร็งลำไส้ใหญ่และทวารหนัก โปรแกรมนี้ถูกพัฒนาขึ้นโดยใช้แนวคิดเชิงบูรณาการจากแบบจำลองการจัดการอาการและทฤษฎีการกำกับตนเองโดยอาศัยความร่วมมือระหว่างพยาบาลและผู้ป่วย กลุ่มตัวอย่างจำนวน 64 คน ที่ได้รับการผ่าตัดมะเร็งลำไส้ใหญ่และทวารหนักซึ่งเข้ารับการรักษาในโรงพยาบาลระดับตติยภูมิสามแห่งในกรุงเทพมหานครของประเทศไทยถูกจัดเข้ากลุ่มทดลอง (32 คน) และกลุ่มควบคุม (32 คน) กลุ่มทดลองได้รับโปรแกรมการฟื้นฟูสมรรถภาพภายหลังการผ่าตัดลำไส้ใหญ่และทวารหนักและการดูแลตามปกติ ในขณะที่กลุ่มควบคุมได้รับการดูแลตามปกติ เครื่องมือที่ใช้ในการรวบรวมข้อมูลประกอบด้วย แบบบันทึกข้อมูลส่วนบุคคล มาตรวัดความปวดแบบตัวเลข มาตรวัดอาการท้องอืด แบบบันทึกการทำหน้าที่ของทางเดินอาหารและการรับประทานอาหาร การทดสอบด้วยการเดินในเวลา 6 นาที สไปโรมิเตอร์วัดความจุปอด และแบบประเมินคุณภาพชีวิตของทางเดินอาหาร การประเมินผลลัพธ์กระทำก่อนเริ่มโปรแกรม วันที่ 1 และ 3 หลังผ่าตัด และ 2 สัปดาห์หลังจำหน่ายออกจากโรงพยาบาล วิเคราะห์ข้อมูลด้วยสถิติพรรณนา สถิติไคสแควร์ สถิติทดสอบค่าทีคู่ สถิติทดสอบค่าทีอิสระ และการวิเคราะห์ความแปรปรวนแบบวัดซ้ำ

ผลการศึกษาพบว่า กลุ่มทดลองมีความรุนแรงของความปวดที่น้อยกว่าและความสามารถในการเดินที่มากกว่ากลุ่มควบคุมอย่างมีนัยสำคัญทางสถิติ สำหรับคุณภาพชีวิตของทางเดินอาหารในมิติของอาการและการทำหน้าที่ทางกายภาพพบว่ากลุ่มทดลองมีผลลัพธ์ที่ดีขึ้นอย่างมีนัยสำคัญทางสถิติภายหลังจำหน่ายออกจากโรงพยาบาล 2 สัปดาห์ โดยสรุป โปรแกรมการฟื้นฟูสมรรถภาพภายหลังการผ่าตัดลำไส้ใหญ่และทวารหนักช่วยควบคุมอาการ ส่งเสริมการมีกิจกรรมทางกายหลังผ่าตัด ส่งเสริมการฟื้นตัวและคุณภาพชีวิตของทางเดินอาหารในบางมิติ พยาบาลสามารถใช้โปรแกรมนี้เพื่อเพิ่มความสามารถในการทำหน้าที่และส่งเสริมคุณภาพชีวิตในผู้ป่วยมะเร็งลำไส้ใหญ่และทวารหนักที่ได้รับการผ่าตัด อย่างไรก็ตามควรมีการทดสอบด้วยการทดลองแบบสุ่มและมีกลุ่มควบคุมเพิ่มเติมก่อนที่จะนำโปรแกรมไปใช้ในทางปฏิบัติ

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คำสำคัญ: มะเร็งลำไส้ใหญ่ ผ่าตัดลำไส้ใหญ่และทวารหนัก การฟื้นตัวด้านการทำหน้าที่ การพยาบาลระบบทางเดินอาหาร การพัฒนาโปรแกรม คุณภาพชีวิต โปรแกรมการฟื้นฟูสมรรถภาพ ประเทศไทย

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