Original Study

Feasibility and Efficacy of Presurgical Exercise in Survivors of Rectal Cancer Scheduled to Receive Curative Resection

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Abstract

To examine the potential benefits of exercise before rectal cancer surgery, 12 patients underwent twice-weekly aerobic and resistance training for ~16 weeks. Despite neoadjuvant chemoradiation treatment, results suggest exercise can improve physical attributes prior to surgery which may act to buffer some of the effects of surgery. Presurgical exercise is feasible and may facilitate recovery by enhancing physical reserve capacity.

Background: Localized rectal carcinoma is invasive, with surgical resection the standard treatment. The aim of this study was to determine the feasibility of a supervised presurgical exercise intervention in patients with rectal cancer prior to rectal resection. **Patients and Methods:** Twelve patients volunteered to undertake twice-weekly aerobic and resistance exercise for ~16 weeks prior to surgery. At baseline, presurgery, and ~8 weeks postsurgery, muscle strength and physical performance, body composition, quality of life, and fatigue were assessed. **Results:** Ten patients completed training, with 80% completing more than one-half of the exercise sessions. Muscle strength improved 9% to 29% at presurgery, although this was not statistically significant, and declined postsurgery ($P < .05$). Importantly, postsurgery strength levels were comparable with pretraining levels. Lean mass was preserved at presurgery despite neoadjuvant chemoradiation treatment, whereas postsurgery lean mass decreased ($P < .05$) compared with baseline (-3.2 ± 5.4 kg) and presurgery (-3.7 ± 5.4 kg). There were no substantial changes in quality of life or fatigue. **Conclusion:** Presurgical exercise is feasible, leading to modest improvements in some outcomes despite chemoradiation treatment. The detrimental effects of surgery were evident, especially in relation to lean mass. As such, exercise may facilitate recovery by enhancing presurgery physical reserve capacity, thereby providing a buffer to declines following surgery.

Clinical Colorectal Cancer, Vol. ■, No. ■, ■-■
Keywords: Bowel cancer, Exercise, Prehabilitation, Preoperative, Surgery

Introduction

Rectal carcinoma is an invasive cancer, with incidence rates remaining high[1] despite innovative improvements in treatment techniques and promotion of early detection.[2] Surgery is the main curative option for localized rectal cancer; however, it is associated with major complications, contributing to prolonged hospitalization.[3] Physical exercise as an intervention strategy can reduce many adverse effects of cancer treatments and is now recommended by the American College of Sports Medicine.[4]

Traditionally, the role of exercise has centered on the postsurgical period, which, for high-risk populations with rectal cancer may not be favorable, owing to the excessive levels of anxiety faced by patients and various other underlying conditions such as fatigue, additional treatment, other underlying conditions, and general concern of disrupting the healing process.[5] For a variety of surgical procedures, prioritizing exercise before surgery leads to fewer postsurgical complications and shorter hospitalization,[5-8] improving health outcomes and reducing health care costs.[7,9] Moreover, a higher presurgical physical health or fitness level correlates with lower long-term mortality and complications,[10] and exercise undertaken on a

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Submitted: Oct 27, 2016; Accepted: Mar 13, 2017

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1533-0028/$ - see frontmatter
http://dx.doi.org/10.1016/j.clcc.2017.03.010

regular basis diminishes and prevents several chronic diseases.[11] The postsurgical period is associated with the loss of muscle strength and reduction in physical function, and these declines may be especially problematic for patients with rectal cancer who already have a poor presurgical physical function, which may have been exacerbated during this period by chemotherapy and radiation treatment. We recently reviewed the literature regarding presurgery exercise interventions in cancer patients and found that, although the majority of studies indicated beneficial effects on function and physical capacity, no studies had been undertaken of aerobic and resistance exercise in patients with rectal cancer in a supervised clinical setting.[6]

Therefore, the purpose of this study was to determine the feasibility and potential effectiveness of a supervised presurgical exercise program consisting of combined resistance and aerobic training in patients with rectal cancer scheduled to receive rectal resection. The primary outcome was the effects of ~16 weeks of presurgical exercise on muscle strength, with secondary outcomes of physical performance, body composition, fatigue, and quality of life (QOL). Assessments were undertaken at baseline, presurgery, and ~8 weeks postsurgery.

Patients and Methods

Patient Recruitment

Nineteen patients with localized rectal cancer scheduled for rectal resection were referred by their attending specialist at a hospital in Perth, Western Australia, to the chief investigator for potential inclusion in the study. Two patients did not meet the inclusion criteria, and 5 declined to participate, resulting in 12 men and women enrolling in the study. Patients were then screened by an accredited exercise physiologist. The eligibility criteria to participate included patients scheduled for surgery for localized rectal cancer; absence of any acute illness or any musculoskeletal, cardiovascular, or neurologic disorder that could inhibit the ability to walk 400 m unassisted and undertake upper- and lower-body exercises; and having obtained medical clearance from their general practitioner. The study was approved by the University Ethics Committee, and all participants provided written informed consent.

Exercise Intervention

The exercise program consisted of 2 60-minute supervised sessions per week over a period of ~16 weeks before surgery at a University exercise clinic. In addition, a home-based activity log sheet was provided at baseline for patients to complete aerobic exercises (at least 2 × 15 minutes or more per week), in order to meet the physical activity guideline of 150 minutes per week,[4] and this was monitored weekly throughout the exercise intervention. Supervised sessions commenced with a 5-minute warm-up, followed by progressive resistance training targeting the major muscle groups of the upper and lower body and included the chest press, seated row, latissimus pull-down, leg extension, leg curl, and leg press exercises. Participants performed 2 to 4 sets per exercise at a 6 to 12 repetition maximum (RM) intensity in a periodized fashion where the number of sets and repetitions were altered.[12] The exercises were performed using standard resistance training machine equipment. Aerobic exercise was undertaken for 20 minutes at an intensity of 60% to 80% of estimated maximum heart rate and included activities such as walking or jogging on a treadmill and cycling or rowing on a stationary ergometer. The session concluded with a 5-minute cool-down period. All sessions were conducted with one-on-one supervision by a qualified and accredited exercise physiologist who ensured safety and adherence to correct lifting techniques.

Muscle Performance

Dynamic muscle strength for chest press, seated row, leg press, and leg extension exercises were assessed using the 1-RM method, which is the maximal weight that can be lifted 1 time. To evaluate muscle endurance, the maximal number of repetitions performed at 70% of the baseline 1-RM for the chest press and the leg press were used. Muscle endurance resistance values for pre- and postsurgery assessments were determined using baseline measurements. These protocols have been shown to be reliable and valid.[13]

Physical Performance

A battery of tests were used to assess physical performance and included the usual and fast 6 m walk, 6 m backwards walk (as a measure of dynamic balance), repeated chair rise (lower body muscle function incorporating muscle power, strength, and endurance), stair climb, and the 400 m walk (as a measure of cardiorespiratory endurance and walking endurance). Tests were performed in triplicate, except for the 400 m walk, with recovery time between trials.

Body Composition

Total body lean mass (LM), fat mass (FM), and percentage of fat were assessed by dual-energy X-ray absorptiometry (DXA, Hologic Discovery A, Waltham, MA). In addition, the appendicular regional composition was determined by manipulation of segmental lines according to specific anatomical landmarks with appendicular skeletal muscle (ASM) calculated from the sum of upper- and lower-limb LM.[14]

QOL, Fatigue, and Physical Activity Measurements

The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC-QLQ C30, version 3.0) was used to assess changes in levels of health-related QOL with an increase in scores indicating enhancement for Global Health and all functioning domains (Physical, Role, Emotional, Cognitive, Social), and a decrease in scores indicating reduced severity for all symptom-related domains and financial difficulties. The questionnaire has been well-validated and used frequently to assess QOL in survivors of cancer.[15] Self-reported physical activity was assessed with the Leisure Score Index of the Godin Leisure-time Exercise Questionnaire, with higher values indicating higher physical activity levels.[16] General well-being was assessed using the 36-Item Short Form Health Survey (SF-36) version 2.[17] This questionnaire contains 8 scales, where 5 scales (physical function, role physical, role emotion, social function, bodily pain) measure the degree of dysfunction, and 3 scales (general health perceptions, vitality, mental health) consider the full range of health conditions, with higher scores indicating better function/health. Fatigue was measured with the validated 30-item short form of the Multidimensional Fatigue Symptom Inventory (MFSI-SF) developed for use with patients with cancer,[18] with lower scores indicating lower fatigue levels.