



## Review

## A systematic review of prehabilitation programs in abdominal cancer surgery

Yasser Hijazi <sup>a</sup>, Umair Gondal <sup>b</sup>, Omer Aziz <sup>a, b, \*</sup><sup>a</sup> Colorectal and Peritoneal Oncology Centre, The Christie NHS Foundation Trust, UK<sup>b</sup> Faculty, Institute of Cancer Sciences, University of Manchester, UK

## HIGHLIGHTS

- Prehabilitation programs are heterogeneous in terms of composition, modes of delivery and duration.
- Outcome measures used to quantify the impact of prehabilitation programs were also heterogeneous between studies.
- All these aspects require standardisation prior to the evaluation of prehabilitation on a larger scale.

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## ABSTRACT

**Introduction:** Prehabilitation programs aim to optimise patients in order to enhance post-operative recovery. This study aims to review the composition of prehabilitation programs for patients undergoing major abdominal cancer surgery and define the outcome measures that are used to evaluate this intervention.

**Methods:** A systematic literature review of all comparative studies on prehabilitation versus standard care in patients undergoing abdominal cancer surgery was performed in accordance with PRISMA guidelines. Literature search was performed using Medline, OVID, EMBASE, Google Scholar, and Cochrane databases. Outcomes of interest included prehabilitation program composition (exercise, nutritional, and psychological interventions), duration, mode of delivery, and outcome measures used to determine impact of prehabilitation versus standard care.

**Results:** 9 studies (7 randomised controlled and 2 prospective non-randomised trials) comprising of 549 patients (281 prehabilitation versus 268 standard care) were included in this review. 5 studies reported patients undergoing surgery for colorectal cancer, 2 for bladder tumours, 1 for liver resections, and 1 involving unspecified abdominal oncological operations. The 6 min walk test (6MWT) was used in 4 studies to measure functional capacity with a threshold of >20 m improvement at 4–8 weeks post-operatively deemed significant (distance range from 278 to 560 m). Changes in anaerobic threshold and  $\text{VO}_2^{\text{max}}$  with prehabilitation were evaluated in 5 studies (ml/kg/min). Health-related quality of life was evaluated using SF-36 system, anxiety assessed using hospital anxiety and depression score (HADS). Post-operative complications were classified according to the Clavien-Dindo classification with no significant difference between prehabilitation and standard care groups.

**Conclusion:** Prehabilitation programs in patients undergoing abdominal cancer surgery remain heterogeneous in their composition, mode of administration, outcome measures of functional capacity that are used to evaluate their impact. All these aspects require standardisation prior to the evaluation of prehabilitation on a larger scale.

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## 1. Introduction

The effectiveness of prehabilitation programs has been demonstrated in a number of specialities including cardiothoracic [1], orthopedic [2], and bariatric [3] surgery. Patients undergoing

\* Corresponding author. Colorectal and Peritoneal Oncology Centre, The Christie NHS Foundation Trust, Wilmslow Road, Manchester, M20 4BX, UK.

E-mail address: [Omer.Aziz@christie.nhs.uk](mailto:Omer.Aziz@christie.nhs.uk) (O. Aziz).

abdominal cancer surgery for gastrointestinal, urological, gynecological, hepatobiliary and pancreatic malignancies are group that may benefit from this intervention, especially because, factors such as cachexia, myopenia, and sarcopenia have all been shown to be associated with poor long-term outcome [4]. Furthermore by potentially improving the post-operative recovery and short-term outcomes in these patients, prehabilitation offers the potential to improve their quality of life and tolerance to adjuvant treatments such as chemotherapy [4]. The challenge however, is that in the case of elective abdominal cancer surgery there is often just a 4–6 week window of opportunity for them to undergo this prehabilitation.

Although a large amount of data on prehabilitation programs exist, there remains significant heterogeneity in their composition. Prehabilitation programs were initially developed with preoperative physical exercise as the core intervention to improve a patient's functional capacity reserve [5]. Dietary counseling and protein supplementation were subsequently added to augment the physical exercise [6]. Finally, psycho-social support in the form of anxiety reduction measures was introduced. A 'tri-modal' prehabilitation program therefore comprises of exercise, nutritional, and psychosocial components delivered in the run-up to surgery [6].

For patients undergoing major abdominal cancer surgery, it remains unclear what the optimal composition of such programs should be and how they should be delivered. Outcome measures that have been used to measure the effect of prehabilitation include: pre-operative outcomes (patient compliance, changes in functional exercise capacity, and mood), short-term post-operative outcomes (length of hospital stay and postoperative complications), and long-term post-operative outcomes (health-related quality of life, cancer specific, and overall survival) [7–10]. This systematic review aims to summarise the evidence on prehabilitation before abdominal cancer surgery with regards to the optimal composition, delivery, and outcomes measures used to evaluate prehabilitation programs.

## 2. Methods

### 2.1. Search strategy

A comprehensive literature search was undertaken according to PRISMA guidelines [11] using Medline, EMBASE, Ovid, Google Scholar, and Cochrane databases to identify comparative studies on prehabilitation versus standard care in patients undergoing major abdominal cancer surgery. The MeSH headings used included: abdominal surgery, AND prehabilitation, AND exercise, AND pre-operative care, AND oncology, OR cancer, OR tumour, OR malignancy, OR neoplasm.

### 2.2. Study selection

In order to be included on this review, studies had to be prospective and compare prehabilitation programs versus standard care in patients undergoing major abdominal cancer surgery. These programs could include physical exercise, nutrition, and/or psychological support components. All studies of prehabilitation programs in patients undergoing other types of surgery (such as cardiothoracic or orthopedic surgery) were excluded. Furthermore, studies containing patients undergoing multiple types of surgery were excluded unless the data for abdominal cancer surgery patients could be separately extracted.

### 2.3. Data extraction

Two reviewers (Authors) independently identified and extracted data from the studies included on this review. Where there was discordance between reviewers, a third reviewer arbitrated. Outcomes of interest included: study characteristics, patient demographics, prehabilitation program composition (exercise, nutritional, and/or psychological components), duration, mode of administration, compliance, outcomes measures used to quantify the impact of prehabilitation programs (changes in functional capacity, cardiopulmonary fitness, psychological assessments, post-operative complications, and health-related quality of life).

### 2.4. Quality assessment

The quality of each study was assessed using the Delphi list for quality assessment of randomised clinical trials (RCT) for conducting systematic reviews [12]. Each RCT included in this systematic review, was checked for method of randomisation, blinding, similarity of groups at baseline, dropout rate, adherence, outcome measures assessment, sample size, and pre-specified outcomes. For the non-RCTs, the quality assessment checked for blinding (whether there was a blinded outcome assessor and whether either the care provider or patients were blinded) and for adequate description of the control/comparison group. Two reviewers independently undertook the quality assessment.

## 3. Results

Fig. 1 is a flow diagram of the studies identified in this review. 12 prospective comparative studies fulfilled the inclusion criteria. Exclusion of overlapping patient groups led to the exclusion of 3 studies. 9 studies published between 2009 and 2015 were included in this review [7–10,13–17]. 7 of these were randomised controlled trials [7–9,13–16] and 2 were non-randomised controlled trials [10,17] containing a total of 549 patients (281 prehabilitation versus 268 standard care).

### 3.1. Study characteristics

In 7 studies [8,10,14–17] the prehabilitation group was compared with a standard care group. In one study [9] the prehabilitation group was compared with a rehabilitation group whereas in another study [7] the comparison was between two prehabilitation groups with differing modes of physical exercise. Five studies reported on patients undergoing surgery for colorectal cancer [7,9,10,14,17], two for bladder tumours [15,16], one for liver resection [8], and one involving unspecified abdominal oncological operations [13]. Table 1 outlines the characteristics of the studies included in this review and their quality.

### 3.2. Composition of prehabilitation program

Table 2 shows the composition of the prehabilitation programs which were trimodal in 2 studies [9,10], (physical exercise, nutritional supplementation and psychological support), and unimodal in 7 studies (pre-operative physical exercise alone) [7,8,13–17]. The outcome measures used to detect the changes in functional capacity were either 6MWT (the maximum distance the participant can walk in 6 min) [7,9,10,15], or anaerobic threshold (AT) and maximum oxygen uptake ( $VO_2^{\max}$ ) measured by the cycle ergometer [8,14,16,17]. One study [13] measured the respiratory muscle endurance as an indicator of functional capacity.

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