

Systematic review

Effect of total-body prehabilitation on postoperative outcomes: a systematic review and meta-analysis

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Abstract

Objective To systematically review the evidence of pre-operative exercise, known as ‘prehabilitation’, on peri- and postoperative outcomes in adult surgical populations.

Design Systematic review and meta-analysis.

Data sources CENTRAL, Medline, EMBASE, CINAHL, PsycINFO and PEDro were searched from 1950 to 2011.

Methods Two reviewers independently examined relevant, English-language articles that examined the effects of pre-operative total-body exercise with peri- and postoperative outcome analysis. Given the nascence of this field, controlled and uncontrolled trials were included. Risk of bias was assessed using the Cochrane Risk of Bias Assessment tool. Only data on length of stay were considered eligible for meta-analysis due to the heterogeneity of measures and methodologies for assessing other outcomes.

Results In total, 4597 citations were identified by the search strategy, of which 21 studies were included. Trials were generally small (median = 54 participants) and of moderate to poor methodological quality. Compared with standard care, the majority of studies found that total-body prehabilitation improved postoperative pain, length of stay and physical function, but it was not consistently effective in improving health-related quality of life or aerobic fitness in the studies that examined these outcomes. The meta-analysis indicated that prehabilitation reduced postoperative length of stay with a small to moderate effect size (Hedges’ $g = -0.39$, $P = 0.033$). Intervention-related adverse events were reported in two of 669 exercising participants.

Conclusion The literature provides early evidence that prehabilitation may reduce length of stay and possibly provide postoperative physical benefits. Cautious interpretation of these findings is warranted given modest methodological quality and significant risk of bias.

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Exercise; General surgery; Preoperative care; Preoperative period; Rehabilitation; Postoperative period

Keywords: Pre-operative exercise; Prehabilitation; Postoperative outcomes; Systematic review; Meta-analysis

Introduction

The acute postoperative period is associated with a marked reduction in physical function and health-related

quality of life (HRQOL) [1]. Pre-operative physical conditioning is an increasingly common strategy aimed at improving postoperative outcomes, including length of stay (LOS), functional capacity and peri-operative complications [2–5]. Furthermore, the typical waiting period may represent an ideal time to invest in chronic health with a general exercise programme, ostensibly capitalising on the psychological impact (‘teachable moment’) of recent diagnosis to facilitate changes in health behaviour that include regular physical activity. This strategy, known as ‘prehabilitation’,

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commonly employs physiotherapy modalities or more common exercises targeting specific muscles or joints, often without targeting the systemic musculoskeletal and cardiovascular deconditioning that follows prolonged immobilisation. This focused approach ignores evidence from multiple studies, demonstrating that pre-operative systemic physical fitness positively predicts peri-operative complications and functional recovery, that have clinical and economic salience [6,7]. Consequently, a more focused examination of trials that employ broader fitness enhancement strategies is needed to determine whether total-body exercise can improve the surgical experience and recovery. While recent reviews have described a net benefit of prehabilitation [3–5], they have not conducted a meta-analysis nor have they focused specifically on total-body prehabilitation strategies across surgical populations. Therefore, the purpose of this study was to systematically review and meta-analyse the current literature examining the effect of total-body prehabilitation interventions on peri- and postoperative outcomes in adults undergoing surgical intervention.

Methods

Search strategy

Studies published in English between 1950 and August 2011 were recovered from the following databases by an experienced medical information specialist: the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, EMBASE, CINAHL, PsycINFO and PEDro. Search terms are presented in Appendix A (see online supplementary material). Hand searches of the reference lists of included studies were conducted to identify any additional relevant trials. Fig. A (see online supplementary material) shows a summary of the selection process. The corresponding authors of included trials were contacted to identify any potential additional relevant trials.

Two reviewers independently reviewed abstracts identified by the search for potentially relevant trials. Full-text articles of relevant studies were obtained and reviewed to confirm inclusion. Discrepancies between reviewers regarding inclusion were resolved by a third reviewer.

Inclusion criteria

Eligible trials included prospective, prehabilitation interventions that evaluated the effect of pre-operative total-body exercise for patients aged ≥ 18 years undergoing curative or palliative surgery. Exercise was operationally defined as non-site-specific structured physical activity that included cardiovascular and/or resistance training of the upper and/or lower extremities. Studies were included when the intervention(s) included exercise prescriptions with an indication of frequency (sessions/week), intensity (e.g. percentage maximum heart rate, rating of perceived exertion, etc.), time

(duration of exercise session in minutes) and/or type of exercise (e.g. walking, cycling, resistance training). There was no limitation to intervention duration or intensity. Studies for inclusion required both pre- and peri- or postoperative outcome measurements; given the nascence of this field, there was no exclusion based on study design.

Data extraction

Two reviewers independently evaluated all studies for content and methodological quality using a standardised data extraction table. The reviewers were blinded to each other's abstraction process but were not blinded to each study's authors, date, journal or title. Study outcomes were grouped according to the following categories: HRQOL, pain, musculoskeletal and functional task performance, aerobic fitness, postoperative LOS and healthcare utilisation, peri-operative complications and adverse events. Outcome statistical significance was set to $P \leq 0.05$ and intention-to-treat results were used when available. The corresponding authors of included studies were contacted by email to verify the methodology and results.

Risk of bias assessment

Study risk of bias was evaluated according to the Cochrane Risk of Bias Assessment tool [8] (Table 1). A third reviewer resolved any disagreements regarding classification of study quality components.

Meta-analysis

A meta-analysis was performed on outcomes that were used consistently by three or more studies using Comprehensive Meta-Analysis, Version 2 [9]. Effect size was calculated as Hedge's g , which denotes the mean difference between the intervention and control groups divided by the pooled standard deviation of the two groups. To aggregate effect sizes, each effect size was weighted by the inverse of its variance, while the weighted effect sizes were summed across studies and then divided by the sum of the weights.

Cochrane's Q test and the I^2 statistic were used to assess heterogeneity between studies [10]. Publication bias was assessed by conducting a funnel plot, the Begg and Mazumdar rank correlation test [11] and Egger's regression asymmetry test [12].

Results

Search results

The database search yielded 4597 citations, plus an additional 41 studies identified through hand searches and communication with authors. In total, 89 candidate studies were examined in detail, of which 22 studies met the inclusion criteria [6,13–33] (see Fig. A, online supplementary

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