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Preoperative exercise therapy for elective major abdominal surgery: A systematic review

Sjaak Pouwels [a,b], Rutger A. Stokmans [a,b], Edith M. Willigendael [c], Simon W. Nienhuijs [d], Camiel Rosman [e], Bert van Ramshorst [f], Joep A.W. Teijink [a,b,*]

[a] Department of Vascular Surgery, Catharina Hospital, Eindhoven, The Netherlands
[b] Department of Epidemiology, CAPHRI Research School, Maastricht University, The Netherlands
[c] Department of General and Vascular Surgery, Medical Centre Alkmaar, Alkmaar, The Netherlands
[d] Department of Abdominal Surgery, Catharina Hospital, Eindhoven, The Netherlands
[e] Department of Surgery, Canisius Wilhelmina Hospital, Nijmegen, The Netherlands
[f] Department of Surgery, St. Antonius Hospital, Nieuwegein, The Netherlands

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ABSTRACT

Objectives: The impact of postoperative complications after Major Abdominal Surgery (MAS) is substantial, especially when socio-economical aspects are taken into account. This systematic review focuses on the effects of preoperative exercise therapy (PEXT) on physical fitness prior to MAS, length of hospital admission and postoperative complications in patients eligible for MAS, and on what is known about the most effective kind of exercise regime.

Methods: A systematic search identified randomised controlled trials on exercise therapy and pulmonary physiotherapy prior to MAS. The methodological quality of the included studies was rated using the 'Delphi List For Quality Assessment of Randomised Clinical Trials'. The level of agreement between the two reviewers was estimated with Cohen's kappa.

Results: A total of 6 studies were included, whose methodological quality ranged from moderate to good. Cohen's kappa was 0.90. Three studies reported on improving physical fitness prior to MAS with the aid of PEXT. Two studies reported on the effect of training on postoperative complications, showing contradictory results. Three studies focused on the effect of preoperative chest physiotherapy on postoperative lung function parameters after MAS. While the effects seem positive, the optimal training regime is still unclear.

Conclusion: Preoperative exercise therapy might be effective in improving the physical fitness of patients prior to major abdominal surgery, and preoperative chest physiotherapy seems effective in reducing pulmonary complications. However consensus on training method is lacking. Future research should focus on the method and effect of PEXT before high-risk surgical procedures.

1. Introduction

Surgery is a great stressor to patients and causes large physiological changes, ranging from tissue trauma, immobility and systemic effects to psychological distress and reduced quality of life.[1] Preoperative physical functioning appears to be an important predictor of morbidity and mortality in patients that undergo various types of surgery.[2–5] After Major Abdominal Surgery (MAS), 35% of the patients experience postoperative complications. The majority of these are pulmonary (pneumonia and respiratory failure), which occur in 9% of all patients after MAS.[6,7] Overall 30-day mortality was 10%.[6,7]

Physical capacity appears to be an important predictor for postoperative recovery after MAS.[8–13] Especially in elderly patients, physical capacity is often reduced due to a lack of regular physical activity before surgery.[14–17] Improvement of their functional capacity by means of Preoperative Exercise Therapy (PEXT) may enhance physical capacity at the moment of hospital admission and may facilitate better recovery after surgery.[18]

* Corresponding author. Department of Vascular Surgery, Catharina Hospital, Michelangelolaan 2, P.O. Box 1350, 5602 ZA Eindhoven, The Netherlands. Tel.: +31 (0) 40 239 7155; fax: +31 (0) 40 244 3370.
E-mail addresses: sjaakpwls@gmail.com (S. Pouwels), rutger.stokmans@catharinaziekenhuis.nl (R.A. Stokmans), e.m.willigendael@mca.nl (E.M. Willigendael), simon.nienhuijs@catharinaziekenhuis.nl (S.W. Nienhuijs), crosman@kpnmail.nl (C. Rosman), b.vanramshorst@antoniusziekenhuis.nl (B. van Ramshorst), joep.teijink@catharinaziekenhuis.nl, joep.teijink@upcmail.nl (J.A.W. Teijink).

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Several studies have shown that PEXT is effective in reducing postoperative pulmonary complications and length of hospital stay.[19–22] Recently, Valkenet et al.[23] performed a pooled analysis on the effects of preoperative exercise therapy on postoperative outcomes in cardiac and abdominal surgery patients; they concluded that preoperative training can be effective in reducing postoperative complications and length of hospital stay. By contrast, Lemanu et al.[24] reviewed eight randomised controlled trials (RCT's) investigating the correlation of preoperative improvement of physiologic function with recovery after surgery and concluded that the evidence for the effectiveness of PEXT was limited. While these reviews showed conflicting results of heterogenous PEXT programmes in heterogeneous patient populations in several surgical specialties, but there was no separate analysis. Since the effectiveness of preoperative exercise therapy might vary between various types of surgical interventions and various types of PEXT, a systematic review focussing on abdominal surgery only was warranted.

In this study, we performed a systematic review on the effects of PEXT on physical fitness prior to surgery, length of hospital admission and postoperative complications in patients eligible for MAS, and on the most effective exercise regime for this patient population.

2. Method

A systematic search of the available literature was performed to evaluate the effects of preoperative physical exercise therapy (PEXT). The population of interest were all patients undergoing elective MAS, e.g. colorectal, hepatobiliary and gastric surgery. The intervention studied was PEXT compared to regular care (no training programme). Outcomes were the effects of PEXT on preoperative fitness, complications, and convalescence. Also the different training programmes and the possibility to implement such programmes in daily practice were evaluated. Pubmed, Embase, Medline, The Cochrane Library, PEDro, CINAHL and Web Of Knowledge were searched from the earliest date available within each database up to February 2013.

Two reviewers (authors SP and RS), both blinded for authors and titles of the journal, separately screened and selected the studies on the basis of title and abstract. After consensus on the primary selection, both authors independently reviewed the full text of the selected studies to determine the suitability for inclusion, based on the established selection criteria. In addition, cross-references were screened for further eligible studies. Disagreements between the two reviewers were resolved by discussion with each other and the senior author (JT) until consensus was reached.

Studies were included if they met the following criteria:

- The study design was a randomised controlled trial.
- Eligible participants were patients awaiting elective major abdominal surgery (colorectal, liver, pancreatic or biliary).
- The intervention consisted of a preoperative physical exercise training programme (PEXT), defined as a regimen of physical activities (a stand-alone regimen, home-based or supervised) for specific therapeutic goals to gain or increase musculoskeletal and/or cardiovascular and/or respiratory (muscle) function.
- Reported as outcome measurements included improvement of preoperative physical fitness, length of hospital stay, and postoperative complications.

The methodological quality of the included studies was rated using the 'Delphi List For Quality Assessment of Randomised Clinical Trials',[25] which has an acceptable reliability. The Delphi List consists of 8 criteria (Table 1). Two reviewers (authors SP and RS) independently rated the methodological quality of the included studies. The level of agreement between the two reviewers was assessed by a Cohen's kappa score. The score was classified as follows: <0.20 was a poor agreement; 0.21–0.40 indicated a fair agreement; 0.41–0.60 was moderate agreement; 0.61–0.80 good agreement; 0.81–1.00 very good agreement.[26]

If the data in the studies were not presented in a consistent format and systematic reporting of comparable outcome variables was lacking, a systematic review was undertaken.

Table 1
Methodological quality of included studies using the 'Delphi List For Quality Assessment of Randomized Clinical Trials'.[25]

	Criteria[a]								
	1a	1b	2	3	4	5	6	7	8
Dronkers et al. 2010[27]	x	x	x	x	x	–	–	x	x
Fagevik Olsen et al. 1997[30]	x	x	x	x	–	–	–	x	x
Kim et al. 2009[29]	x	x	D	x	–	–	–	x	x
Kundra et al. 2010[31]	x	x	D	x	–	–	–	x	x
Carli et al. 2010[28]	x	x	x	x	–	–	–	x	x
Kulkarni et al. 2010[32]	x	x	x	x	–	–	–	x	x

X = Yes.
- = No.
D = Don't know.

[a] **The Delphi List**: (1a) Was a method of randomization performed?, (1b) Was the treatment allocation concealed?, (2) Were the groups similar at baseline regarding the most important prognostic indicators?, (3) Were the eligibility criteria specified?, (4) Was the outcome assessor blinded?, (5) Was the care provider blinded?, (6) Was the patient blinded?, (7) Were point estimates and measures of variability presented for primary outcome measures?, (8) Did the analysis include an intention-to-treat analysis?.

3. Results

The primary search strategy produced 1241 results, including 284 duplicate studies. Eight studies were identified as possibly relevant, and underwent critical appraisal on full text. After full text screening, 2 studies were excluded (another duplicate/no MAS). Fig. 1 summarises the search results. The methodological quality of the included studies ranged from moderate to good, as indicated by The Delphi List (Table 1). The level of agreement between the two reviewers was reflected by a Cohen's kappa of 0.90, which represents a very good agreement. The key findings of the included studies are shown in Table 2.

Since the data in the studies were not presented in a consistent format and systematic reporting of comparable outcome variables was lacking, the presented results could not be synthesized through meta-analysis. Consequently, a systematic review was undertaken.

3.1. Compliance

Of the six included studies, only three reported rates of compliance with the PEXT programmes.[27–29] Dronkers et al.[27] found a compliance rate of 97%. Kim et al.[29] found a compliance rate of 74 ± 16%. At the postoperative testing session, two participants in the PEXT group did not make a maximal effort and terminated the test prematurely. Carli et al.[28] found low compliance rates for PEXT, reporting that 16% of the patients had completed the exercise programme. This led to 60% of all patients in both groups who had complete data sets available for analysis.

3.2. Improvement of preoperative physical fitness

Three studies reported on the effects of PEXT on the physical fitness of patients prior to MAS; Dronkers et al.[27] reported a significant preoperative increase in respiratory muscle endurance in patients who received a short period (2–4 weeks) of intensive training,