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Effects of a pre-operative home-based inspiratory muscle training programme on perceived health-related quality of life in patients undergoing coronary artery bypass graft surgery

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Abstract

Objectives Pre-operative inspiratory muscle training has been shown to decrease the incidence of postoperative pneumonia and length of hospital stay in patients undergoing coronary artery bypass graft surgery (CABG). This study investigated if this decrease acted as a mediator on the time course of quality of life.

Design Complementary analyses of a published randomised controlled trial.

Setting and participants The initial trial included patients awaiting CABG surgery at a Dutch university hospital. The secondary analyses used data from the initial trial for patients who had completed at least one quality-of-life questionnaire.

Methods Participants were allocated at random to the intervention group or the usual care group. The intervention group followed a home-based pre-operative inspiratory muscle training programme. Quality of life was measured at five time points. Between-group differences in quality-of-life scores were analysed using mixed linear modelling.

Results The secondary analyses used data for 235 patients. In line with the initial trial, pneumonia and length of hospital stay were decreased significantly in the intervention group. The time courses for all patients showed significant improvements in quality of life after surgery compared with baseline. No significant differences in quality of life were observed over time between the two groups.

Conclusion Despite decreased incidence of pneumonia and length of hospital stay in the intervention group, this study did not find any improvements in quality of life due to the pre-operative home-based inspiratory muscle training programme.

Clinical trial registration number ISRCTN17691887.

Keywords: Quality of life; Inspiratory muscle training; Coronary artery bypass graft surgery

Introduction

Coronary artery bypass graft (CABG) is a surgical revascularisation procedure for patients with coronary artery disease to improve symptoms and survival [1]. CABG has been shown to improve functional status, to relieve incapacitating angina and dyspnoea, to increase maximal exercise capacity and to improve quality of life (QoL) [2–10]. Despite the greatly improved outcomes after CABG in the long term, complications such as dysrhythmias, myocardial infarction, stroke and pulmonary complications can occur in the early postoperative period [1]. These postoperative complications can result in increased length of hospital stay

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(LOS), re-admissions or even death [11–13]. Furthermore, postoperative complications have a negative impact on QoL, while QoL itself is a predictor of cardiac events, hospital (re)admission and mortality in cardiac patients [14–17]. Optimal prevention and treatment of postoperative complications are therefore important to improve both short- and long-term outcomes.

A promising intervention to prevent postoperative pulmonary complications (PPCs) is pre-operative inspiratory muscle training (IMT) [18,19]. Home-based IMT programmes supervised by a physiotherapist have been shown to improve inspiratory muscle strength and endurance in patients with chronic illnesses, and in patients undergoing major invasive surgical operations [18,20–23]. In patients with chronic disease, IMT has been shown to decrease the rating of dyspnoea, and to increase walking distance and QoL [20,21,24]. In patients undergoing an invasive operation such as CABG, IMT is primarily used as pre-operative preparation in high-pulmonary-risk patients to reduce the incidence of PPCs, especially pneumonia, and LOS [18,23,25–27]. To date, no longitudinal and randomised studies have investigated if IMT before CABG can also affect QoL.

This study analysed data that were collected during a randomised controlled trial (RCT) [18]. The RCT showed that a home-based pre-operative IMT programme led to a decrease in postoperative pneumonia and LOS after CABG.

It was hypothesised that the decrease in postoperative pneumonia and LOS in the intervention group acted as an important mediator on the time course of QoL. Therefore, the aim of this study was to investigate whether a pre-operative IMT home programme can affect QoL in patients undergoing CABG surgery by decreasing postoperative pneumonia and/or LOS.

Methods

Background and design

This study undertook secondary analyses of data from a prospective, single-blind RCT. In brief, patients scheduled for CABG with a high pulmonary risk score were allocated at random to receive either usual care (control group) or usual care complemented by a home-based IMT programme before surgery (intervention group). The primary outcome of the RCT was the incidence of PPCs, and the secondary outcome measure was LOS. Data on the effectiveness of IMT on the primary and secondary outcomes have been published elsewhere, and showed that IMT significantly reduced PPCs and LOS after CABG [18]. Alongside the RCT, QoL questionnaires were assessed pre-operatively at baseline (T0), at hospital admission (T1), and 2 weeks (T2), 3 months (T3) and 6 months (T4) postoperatively.

Participants

This study included patients from the initial RCT who had completed at least one QoL questionnaire for at least one time point.

Patients were eligible to participate in the initial RCT if they were scheduled for primary elective CABG surgery and had a high risk score for PPCs [18]. Patients were excluded if they were due to undergo CABG surgery within 2 weeks of initial contact, had a history of cerebrovascular accident, had used immunosuppressive medication within 30 days prior to surgery, had a neuromuscular disorder, were cardiovascularly instable or had an aneurysm [18].

Intervention

Patients in the intervention group received IMT, incentive spirometry and education about deep breathing manoeuvres, coughing and early mobilisation pre-operatively on an individualised and tailored basis. IMT was performed with an inspiratory threshold loading device (Threshold IMT, Respironics New Jersey Inc., Cedar Grove, NJ, USA). The Threshold IMT contains a calibrated spring-loaded valve that provides a constant and predetermined training load during inspiration. The valve opens when the patient meets the set load during inspiration, and expiration is unimpeded. Patients were instructed to train for 20 minutes uninterrupted, 7 days per week, until surgery. The IMT programme stopped the day before surgery. Once a week, a training session was supervised by a physical therapist at the patient's home. The initial inspiratory load was set at 30% of maximal inspiratory pressure (Pi_{max}). Pi_{max} at the mouth was measured at residual volume with a forceful inspiratory manoeuvre [28]. After each training session, patients recorded the training duration, the training intensity (cm H_2O) and the rate of perceived exertion (RPE) on a scale from 0 to 10 in a diary [29]. If patients recorded an RPE score <5 after a training session, they were instructed to increase the inspiratory load of the threshold device by 5% before the next training session. The threshold load was unchanged for RPE scores ≥5.

The control group received instructions on deep breathing manoeuvres, coughing and early mobilisation on the day before surgery. After surgery, both groups received incentive spirometry and chest physical therapy, and all patients followed the same mobilisation scheme.

Outcome measures

The criteria of the initial trial were used for pneumonia and LOS. Pneumonia was defined according to the criteria of the Centers for Disease Control and Prevention, and LOS entails postoperative hospitalisation [18,30].

Perceived health-related QoL and health status were measured using the Medical Outcomes Study Short Form 36 item questionnaire (SF-36) and the EuroQol five dimensions three-level questionnaire (EQ-5D-3L).