INPLASY

The Effect and Influencing Factors of preoperative Inspiratory Muscle Training in Preventing Postoperative Pulmonary Complications in Patients Undergoing Cardiac Surgery: A Meta-analysis

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ADMINISTRATIVE INFORMATION

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 08 September 2023 and was last updated on 08 September 2023.

INTRODUCTION

*R*eview question / Objective To evaluate the prophylactic effects of inspiratory muscle training (IMT) in reducing postoperative pulmonary complications and to identify influencing factors.

Condition being studied Despite significant advancements in perioperative care, cardiac surgeries are still associated with a concerning incidence of postoperative pulmonary complications (PPCs). These complications have a substantial impact on healthcare costs and length of hospital stay (LOS). Among various preoperative rehabilitation strategies, inspiratory muscle training (IMT) has shown great potential in improving respiratory function. After surgery, there is an imbalance between energy demand and supply in ventilatory muscles, leading to muscle fatigue. It is hypothesized that preoperative IMT, utilizing a resistive breathing device, can enhance inspiratory muscle strength and endurance, promoting deep breathing after surgery and subsequently reducing the incidence of PPCs. However, existing research on the effect of preoperative IMT in preventing PPCs in patients undergoing cardiac surgeries has yielded inconsistent conclusions. Several meta-analyses have been conducted on this topic, but they included limited articles and lacked optimized protocol analysis. Therefore, we conducted a comprehensive meta-analysis to assess the intervention effects and influencing factors of preoperative IMT in reducing PPCs in patients undergoing cardiac surgeries.

METHODS

Search strategy Relevant literature was retrieved from electronic databases including PubMed, Web

of Science, Embase, and the Cochrane Library published up to May 6, 2023, without language restrictions. The search strategy combined keywords and MeSH terms as follows: (cardiac surgery.mp or exp thoracic surgery or exp cardiac surgical procedures) AND (inspiratory muscle training.mp or inspiratory muscle strength.mp or respiratory muscle training.mp) AND (preoperat*.mp or presurg*). Additionally, the reference lists of identified studies and meta-analyses were also reviewed to select relevant articles.

Participant or population Patient scheduled for cardiac surgery.

Intervention Inspiratory muscle training (IMT) conducted before cardiac surgery.

Comparator Usual care or sham intervention.

Study designs to be included Randomized controlled trial.

Eligibility criteria (1) randomized controlled trial (RCT); (2) comparison of inspiratory muscle training (IMT) with usual care or sham intervention conducted before cardiac surgery; (3) reporting one or more of the following outcomes: incidence rate of postoperative pulmonary complications (PPCs), length of stay (LOS); (4) sufficient data reported to calculate risk ratios (RRs) or standardized mean difference (SMD) with a 95% confidence interval (95%CI).

Information sources Relevant literature was retrieved from electronic databases including PubMed, Web of Science, Embase, and the Cochrane Library, without language restrictions. Additionally, the reference lists of identified studies and meta-analyses were also reviewed to select relevant articles. Authors of included studies were contacted to obtain additional information.

Main outcome(s) The primary outcome of interest was postoperative pulmonary complications (PPCs).

Additional outcome(s) The secondary outcomes included pneumonia, atelectasis, mechanical ventilation for more than 48 hours, and length of hospital stay (LOS).

Quality assessment / Risk of bias analysis The Cochrane Collaboration's tool was used to evaluate the quality of RCTs in our research, which includes seven major sources of bias and three grades (yes, no, and unclear). Begg's and Egger's tests were used to investigate publication bias when the number of studies was more than ten.

Strategy of data synthesis For each study, heterogeneity was quantified using the $I2$ test and $\chi2$-based Q statistics. If $I2 > 50\%$ or $P < 0.1$, significant heterogeneity was considered, and a random-effects model (DerSimonian and Laird's method) was adopted. Otherwise, a fixed-effects model (Mantel-Haenszel's method) was used. For studies with zero events in one or both groups, 0.5 was added to each cell for the effect measure. The effect sizes of binary outcomes were presented as risk ratios (RRs), and the results for continuous outcomes were expressed as standardized mean difference (SMD) with 95% CI. All of the above analyses were performed using STATA 12.0 software, using two-sided P values.

Subgroup analysis Subgroup analyses based on study design, type of cardiac surgery, IMT duration, and risk category were performed for this primary outcome.

Sensitivity analysis The reliability of available results was evaluated using leak-one-out sensitivity analysis.

Country(ies) involved These studies were conducted in hospitals from Europe (one in Germany, one in Turkey, two in the Netherlands), Africa (one in Egypt), Asia (two in Israel, one in China).

Keywords inspiratory muscle training; cardiac surgery; postoperative pulmonary complications; pneumonia; length of hospital stay.

Contributions of each author
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