

Preoperative Respiratory Physiotherapy and Postoperative Pulmonary Complications in CABG

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Abstract: *It has been shown that Preoperative inspiratory muscle training is able to affect on surgical trauma, the respiratory muscle strength, the lung volumes, and diaphragmatic excursion in patients undergoing surgery. The aim of this short review is to introduce preoperative respiratory physiotherapy as a mean to reduce the postoperative pulmonary complications after coronary artery bypass graft surgery.*

Keywords: *Preoperative Respiratory Physiotherapy, CABG*

1. Introduction

Preoperative inspiratory muscle training is able to affect on surgical trauma, the respiratory muscle strength, the lung volumes, and diaphragmatic excursion in patients undergoing surgery. For example, the preoperative inspiratory muscle training increased the inspiratory muscle strength (maximal inspiratory pressure) and attenuated the negative postoperative effects of open bariatric surgery in obese women for this variable, though not influencing the lung volumes and the diaphragmatic excursion. [1] Coronary artery bypass graft (CABG) affects the functional capacity, resulting in pulmonary complications. Respiratory Muscle Training (IMT) in the preoperative period could be an effective prophylactic. Preoperative IMT was efficient in increasing respiratory muscle strength and FC, reducing the incidence of postoperative pulmonary complications in patients undergoing CABG.[2]

Despite advances regarding patient care in the last few decades, breathing complications as a result of lung injury after surgery such as pneumonia are the leading cause of sickness and death in adults undergoing heart and major abdominal surgery. Training of breathing muscles using a small device at home before surgery seems to make breathing easier and helps strengthen muscles of respiration after surgery. This training may help reduce breathing complications after surgery and may lead to improved patient care and overall health care cost savings for the public health system. Although the available evidence is insufficient in terms of the quality and size of trials, we can conclude that training of breathing muscles before surgery prevents lung complications after surgery [3]. Cardiac surgery is a highly complex procedure which generates worsening of lung function and decreased inspiratory muscle strength. The inspiratory muscle training becomes effective for muscle strengthening and can improve functional capacity. We conclude that inspiratory muscle training was effective in improving functional capacity submaximal and inspiratory muscle strength in this sample of patients undergoing cardiac surgery.[4] To investigate the feasibility and effects of preoperative inspiratory muscle training on the incidence of atelectasis in patients at high risk of postoperative pulmonary complications scheduled for elective abdominal aortic aneurysm surgery. Preoperative inspiratory muscle training is well tolerated and appreciated and seems to reduce the incidence of atelectasis in patients scheduled for elective abdominal aortic aneurysm surgery.[5] Respiratory muscles are affected after cardiac surgeries. It has been shown that domiciliary program of inspiratory muscle training was safe and improved the forced vital capacity and the maximum voluntary ventilation, although the clinical benefits of this program were not clearly

demonstrable. [6] Postoperative pulmonary complications (PPCs) after coronary artery bypass graft (CABG) surgery are a major source of morbidity and mortality, and increase length of hospital stay and resource utilization. The prehospitalization period before CABG surgery may be used to improve a patient's pulmonary condition. The efficacy of preoperative inspiratory muscle training (IMT) in reducing the incidence of PPCs in high-risk patients undergoing CABG surgery has not yet been determined. Preoperative IMT reduced the incidence of PPCs and duration of postoperative hospitalization in patients at high risk of developing a pulmonary complication undergoing CABG surgery.[7] To determine in a pilot study the feasibility and effects of preoperative inspiratory muscle training in patients at high risk of postoperative pulmonary complications who were scheduled for coronary artery bypass graft surgery. Inspiratory muscle training for 2-4 weeks before coronary artery bypass graft surgery was well tolerated by patients at risk of postoperative pulmonary complications and prevented the occurrence of atelectasis in these patients. A larger randomized clinical trial is warranted.[8] Postoperative pulmonary complications (PPCs) after esophagectomy have been reported to occur in 15.9–30% of patients and lead to increased postoperative morbidity and mortality, prolonged duration of hospital stay, and additional medical costs. The results of the logistic regression analysis and multivariate analysis to correct for all considerable confounding factors revealed the rates of PPCs of 6.4% and 24.3% in the PR group and NPR group, respectively. The PR group demonstrated a significantly less incidence rate of PPCs than the NPR group (odds ratio: 0.14, 95% confidential interval: -1.86 ~ -0.22). This study showed that the intensive preoperative respiratory rehabilitation reduced PPCs in esophageal cancer patients who underwent esophagectomy.[9] Diaphragm dysfunction is a complication of cardiac surgery with partial or absent spontaneous recovery in most cases. Surgical diaphragm plication represents the only option when symptoms persist. Because training improves functional nerve recovery after a nerve lesion, we hypothesized that early diaphragm muscle training may be beneficial. Inspiratory muscle training may improve inspiratory muscle strength and increase paralyzed diaphragm mobility.[10] Most patients are readily liberated from mechanical ventilation (MV) support, however, 10% - 15% of patients experience failure to wean (FTW). FTW patients account for approximately 40% of all MV days and have significantly worse clinical outcomes. MV induced inspiratory muscle weakness has been implicated as a contributor to FTW and recent work has documented inspiratory muscle weakness in humans supported with MV. An IMST program can lead to increased MIP and improved weaning outcome in FTW patients compared to SHAM treatment.[11] The aim of this study was to investigate the relationship between respiratory muscle strength, functional capacity, physical activity, and quality of life in preoperative cardiac surgery patients. Quality of life is related with physical activity level and functional capacity in these patients.[12] To investigate the efficiency of inspiratory muscle training (IMT) on postoperative respiratory muscle strength, functional capacity, quality of life, and psychosocial status in patients with coronary artery bypass graft (CABG) surgery. IMT results in faster recovery of inspiratory muscle strength, functional capacity, intensive care unit stay, quality of life and psychosocial status after CABG.[13] To evaluate the effects of a 6-day postoperative in-hospital cardiopulmonary rehabilitation program on inspiratory muscle strength and its potential association with improved functional capacity after coronary artery bypass graft (CABG) surgery. A 6-day rehabilitation program attenuated the postoperative reduction in respiratory muscle strength and also improved the recovery of functional capacity after CABG. The correlation between P_{Imax} and VO_{2peak} during the late postoperative period suggests that inspiratory muscle strength is an important determinant of functional capacity after CABG.[14] Pulmonary complications after cardiac surgery are a leading cause of postoperative morbidity and mortality. that the respiratory muscle weakness is associated with direct or indirect injury to the respiratory muscles during surgery, which may lead to respiratory muscle dysfunction and respiratory failure. It was therefore hypothesized that: (1) there is a decrease in inspiratory muscle strength and endurance following CABG; (2) this weakness is associated with reduced pulmonary function tests (PFTs), impaired gas exchange, and a higher rate of pulmonary complications; and (3) strengthening and increasing the endurance of the ventilatory muscles during the preoperative period can prevent those changes.[15] Heart surgery is associated with an occurrence of pulmonary complications. In a study the researchers aimed to determine whether pre-surgery respiratory physiotherapy reduces the incidence of post-surgery pulmonary complications. They found that preoperative respiratory physiotherapy was related to a lower incidence of atelectasis.[16] Although physiotherapy is an integral part of the multiprofessional team in most ICUs, there is only limited evidence concerning the effectiveness of its procedures. In another study the objectives were to verify if physiotherapy care provided within 24 h/day for hospitalized patients in the ICU reduce the length of stay, mechanical ventilation support, pulmonary infection and mortality compared to a physiotherapy care

provided within 6 h/day. It has been concluded that presence of a physiotherapist in the intensive care unit contributes decisively to the early recovery of the patient, reducing mechanical ventilation support need, number of hospitalization days, incidence of respiratory infection and risk of mortality.[17] Liberation of patients from mechanical ventilation (MV) is an important goal of patient care, to avoid the complications and risks associated with prolonged MV. SA physiotherapists' contributions towards weaning of patients from MV through prescription of exercise therapy, early out-of-bed mobilisation and DBEs is evidence based. Involvement in adjustment of MV settings, decision-making regarding patient weaning, development of weaning protocols for their units and extubation is limited.[18] In a study the researchers aimed to clarify the benefits of early mobilization for mechanically ventilated patients for their survival to discharge to home from the hospital and they found that early mobilization can improve the rate of discharge to home of patients requiring mechanical ventilation because of non-neurological deficits.[19] Prolonged Mechanical Ventilation (MV) of ICU patients is also associated with high health care costs and respiratory muscle weakness which also has been suggested as a possible cause of delayed weaning from MV. Hence, TIMT may be seen as a possible accelerator for successful weaning. The results of the research indicate that TIMT along with conventional physiotherapy produces more significant changes in MIP and weaning period of patients receiving mechanical ventilation as compared to conventional physiotherapy alone.[20] Training of respiratory muscles using threshold inspiratory muscle trainer could be a useful in improving oxygen level and respiratory muscles power in patients with respiratory failure, this study revealed that, respiratory muscles training could be a helpful tool to improve oxygen level and inspiratory muscle strength for respiratory failure patients.[21] It has also been shown that preoperative respiratory physical therapy improves inspiratory muscle strength and QoL scores in patients undergoing upper abdominal surgeries.[22] There are various reasons why weaning and extubation failure occur, but ineffective cough and secretion retention can play a significant role. Cough augmentation techniques, such as lung volume recruitment or manually- and mechanically-assisted cough, are used to prevent and manage respiratory complications associated with chronic conditions, particularly neuromuscular disease, and may improve short- and long-term outcomes for people with acute respiratory failure. However, the role of cough augmentation to facilitate extubation and prevent post-extubation respiratory failure is unclear. Very low-quality evidence from single trial findings suggests that cough-promoting techniques might increase successful removal of the breathing tube and decrease the time spent on mechanical ventilation, while not causing harm.[23] A beneficial adjuvant role of chest physiotherapy (CPT) to promote airway clearance, alveolar recruitment, and ventilation/perfusion matching in mechanically ventilated (MV) patients with pneumonia or relapsing lung atelectasis is commonly accepted. However, doubt prevails regarding the usefulness of applying routine CPT in MV subjects with no such lung diseases. In general, CPT was safe and supportive, yet had debatable or no significant impact on any relevant patient outcome parameter, including pneumonia. [24]

2. Acknowledgements

We appreciate all who helped us to exert this study.

3. References

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