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The effects of respiratory physiotherapy after lung resection: Protocol for a systematic review

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ABSTRACT

Background: The main treatment of lung cancer (stage 1 and 2) is lung resection surgery. The risk of postoperative pulmonary complications is high and therefore standard postoperative care involves respiratory physiotherapy. The purpose of this systematic review is to create an overview of the evidence on respiratory physiotherapy after lung resection surgery on mortality rate (within 30 days) and postoperative pulmonary complications.

Methods and analysis: The review will include randomized or quasi-randomized controlled studies investigating the effect of all types of respiratory physiotherapy on mortality and postoperative pulmonary complications after lung resection surgery. Furthermore, the effect of respiratory physiotherapy is evaluated on secondary outcomes such as length of hospital stay, lung volumes and function, and adverse events. The method of the planned review is described in this paper. The literature search will include the databases PubMed, Cochrane (Central), Embase, Cinahl and PEDro. The literature search is being performed in 2017. If meta-analyses are not undertaken, a narrative synthesis of the available data will be provided. The protocol was registered in PROSPERO on the 10th of October 2016 (registration number CRD42016048956).

Ethics and dissemination: Conclusion of this systematic review is expected available in the second half of 2017.

1. Background

1.1. Description of the condition

Lung resection surgery is the primary treatment for patients at stage I and II lung cancer [1]. Despite an increasing survival rate for lung cancer, it is still the leading cause of cancer death and the main reason for performing lung resection surgery [2]. Cigarette smoking remains the predominant risk factor for lung cancer, and it is estimated that as much as 90% of the disease is related to the use of tobacco [1,3]. Data on patient demographics show that lung resection surgery is performed almost equally on men and women, and that the median age is 63 years. Roughly a fourth of the population are diagnosed with chronic obstructive pulmonary disease (COPD) and, dependent on the type of surgery, 24–32% had hypertension and 5–10% had coronary artery disease [4,5]. Regarding patients undergoing lobectomy, preoperative chemotherapy or radiation therapy was provided for 8.5% and 2.3%, respectively [4]. In 2014 878 patients underwent lung surgery at Danish hospitals. Of these, 80% were lobectomy, 12% wedge resection, 4% pneumonectomy, 3% segment resection, and 1% explorative surgery. The thoracic procedures were in 60% of the cases performed by video-assisted surgery (VATS). Overall, the median length of hospital stay (LOS) was 4 days (with maximum LOS of 59 days) [5].

Lung resection surgery reduces health-related quality of life for months, in particular physical functioning, and one of the major concerns for patients is the possibility to resume an acceptable lifestyle [6]. Lung surgery involves a high risk of sustaining postoperative pulmonary complications (PPC) that may impair patient recovery [7–9]. PPC imply considerable economical and patient related consequences, as PPC are associated with increased LOS,

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intensive care unit admission, and increased mortality [10]. The incidence rate of PPC differs from 14.5%–37%. The difference in rate of incidence is primarily caused by variation in definition criteria of PPC [7,8,10]. Additionally, factors such as extended resection, type of lung resection, preoperative chemotherapy and comorbidity (e.g. COPD, peripheral vascular disease, and coronary artery disease) are associated with increased risk of PPC [11]. PPC include, i.a., significant hypoxia and atelectasis, pneumonia, exacerbation of COPD, various types of upper airway obstruction, pulmonary edema, and tracheal re-intubation [10,12]. Physiologically, pulmonary complications can lead to reduced lung volumes and subsequent low oxygenation [13]. Retained pulmonary secretion and physically compression of lung tissue during surgery are often the cause of atelectasis [14]. Furthermore, the risk of developing pneumonia, which may cause purulent secretion and hypoxia, is higher in patients undergoing lung resection surgery because the normal defense mechanism of the lungs is compromised [10,14]. This is due to a higher occurrence of atelectasis, pain-related depression of the cough mechanism, and direct passage for microorganisms to lower airways through the endotracheal tube [14]. The incidence of postoperative pneumonia varies depending on risk factors ranging from 1.5% to as high as 15.3% [10]. When considering the source of infection and preventive strategies it is important to distinguish between community-acquired pneumonia and hospital-acquired (≥48 h post-hospital admission) or ventilator-acquired pneumonia (>48–72 h post-intubation) [10]. The distinction between the types of pneumonia is likewise relevant to take into account when deciding the optimal time of outcome measurement when examining the effect of preventive strategies [10].

1.2. Description of the intervention

Respiratory physiotherapy is an important adjuvant in fast-track regimen following lung resection surgery because respiratory care, as well as pain control and supplemental oxygen requirement, are factors that reduce PPC, limit LOS, and improve patient outcomes [9,15,16]. The central aim for respiratory physiotherapy is to optimize ventilation and clear airway secretions in order to improve gas exchange and make breathing easier. Respiratory physiotherapy covers many different treatment techniques and the utilization of these techniques varies to a great extent [17,18]. Ambulation and frequent position change (position change in bed and sitting out of bed) are central parts of postoperative recovery programs and are both considered an interdisciplinary teamwork responsibility and an important aspect of respiratory physiotherapy [15,17]. Respiratory physiotherapy also comprises techniques that promote increasing lung volumes such as deep breathing exercises with or without devices (e.g. incentive spirometry), positive expiratory pressure breathing (PEP), intermittent positive pressure breathing, or continuous positive airway pressure breathing (CPAP) [19,20]. Other techniques focus on airway clearance; postural drainage, percussion, vibration and shaking, active circle of breathing techniques including forced expiration, high-frequency chest wall oscillation, intrapulmonary percussive ventilation, huffing, and coughing [21]. Furthermore, some physiotherapists use different exercises for the upper extremities, soft-tissue release techniques to lengthen individual tight muscles, or osteopathic manipulative treatments to enhance thorax mobility (e.g. bilateral rib rising, myofascial release of diaphragm or restrictive connective tissue) [22].

1.3. How the intervention might work

Ambulation, position change and breathing techniques may improve respiratory function postoperatively by increasing functional residual capacity (FRC) and ventilation, and by minimizing closing volumes [20]. The change in breathing pattern caused by positive expiratory pressure has been shown to decrease expiratory flow and increase expiratory time which leads to a smaller exhaled volume and an increase in FRC [20]. Also, the increased positive pressure during breathing is believed to reinflate collapsed alveoli by allowing air to be redistributed through collateral channels, allowing pressure to build up distal to the obstruction, and by promoting the movement of pulmonary secretions towards larger airways [21]. Some airway clearance techniques include different types of vibration which is believed to decrease collapsibility of the airways and to promote loosening pulmonary secretions [21]. Exercises for the upper extremities and thorax mobility techniques are believed to enable a more freely chest wall excursion necessary for a normal breathing pattern and thereby improving oxygenation [22].

To our knowledge, the only review investigating the effect of respiratory physiotherapy on PPC and mortality after lung resection so far was conducted by Varela et al. (2011), The authors conclusion was unclear due to a lack of well designed clinical trials [23]. The review, however, did not include descriptions of a systematic method and search strategy, why it is uncertain if all relevant literature was identified. Furthermore, new studies on the subject may have been published since then. A systematic review from 2014 concluded that CPAP initiated during the postoperative period following major abdominal surgery might reduce postoperative atelectasis, pneumonia and re-intubation but its effect on mortality, hypoxia and invasive ventilation were uncertain [12]. Another systematic review from 2010 investigating the effect of PEP after abdominal and thoracic surgery showed uncertain effect of the treatment [24]. These systematic reviews also included patients undergoing abdominal and cardiac surgery, respectively, which could influence the outcome of respiratory physiotherapy on PPC and mortality. Overall, we find it relevant to conduct a systematic review concerning only patients undergoing lung surgery.

1.4. Why is it important to do this review?

Lung surgery is frequently associated with PPC and hence, substantial resources are spent on respiratory physiotherapy in order to prevent PPC and thereby reduce mortality and enhance health-related quality of life by facilitating patient recovery [9]. Accordingly, it is relevant to compose a better overview of the literature investigating the effect of respiratory physiotherapy specifically following lung surgery in order to evaluate whether we should continue using respiratory physiotherapy for this group of patients [17]. If possible, we will evaluate different types of respiratory physiotherapy and the effect on different risk groups of PPC.

2. Objectives

The objective is to investigate the effects of respiratory physiotherapy after lung resection surgery on mortality rate (within 30 days) and postoperative pulmonary complications.

3. Methods

PRISMA guidelines will be followed in this review [25].

3.1. Criteria for considering studies for this review

3.1.1. Types of studies

The review will include randomised and quasi-randomised controlled trials only.