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Literature Review: Methods for Prevention And Control Of Pulmonary Complications In Active Cycle Breathing

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ABSTRACT

The decrease in lung functional capacity will be followed by a decrease in the value of maximal inspiratory pressure and maximal expiratory pressure, both of these values indicate a significant decrease in respiratory muscle strength after the Coronary Artery Bypass Graft procedure, which can increase mortality rates and length of hospital stay. The purpose of this study was to repair blocked and narrowed arteries by cutting and replacing the blocked arteries from healthy vessels. The research method used the Patient method: Post ACBG; intervention: active cycle of breathing technique; comparison: other physiotherapy interventions; outcome: functional lung capacity. The results showed that active cycle of breathing technique and routine chest physiotherapy interventions had the same effect on reducing pain, this was evidenced by a p-value of 0.001 which means that active cycle of breathing technique and routine chest physiotherapy showed a significant effect on reducing pain in post coronary artery bypass graft patients. The conclusion of this study is that Active Cycle of Breathing Technique exercises have been proven to improve the functional lung capacity of post coronary artery bypass graft patients.

Keyword : Prevention Methods, Control, Pulmonary Complications, Breathing, Active Cycle

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1. Introduction

The entry points for Mycobacterium Tuberculosis germs are the respiratory tract, digestive tract and open wounds on the skin. Most tuberculosis (TB) infections occur through the air, namely through inhalation of droplets containing tubercle bacilli from an infected person. Tuberculosis is a disease controlled by an immune response that causes an inflammatory reaction. The bacteria are transported through the respiratory tract. Tuberculosis bacilli that reach the alveolar surface are usually inhaled as units of one to three bacilli. Larger clumps tend to be retained in the nasal passages and large bronchi and do not cause disease. Once in the alveolar space, the tubercle bacilli provoke an inflammatory reaction. Polymorphonuclear leukocytes are seen at the site and phagocytose the bacteria but do not kill the organisms. After the first days leukocytes are replaced by macrophages. The affected alveoli will undergo consolidation and symptoms of acute pneumonia will appear. The primary lung lesion is called the Ghon focus and the combination of regional lymph node involvement and the primary lesion is called the Ghon complex.

Another response that may occur in areas of necrosis is liquefaction, in which liquid material is released into the bronchi and forms a cavity. The tubercular material released from the cavity wall enters the tracheobronchial tree. This process may be repeated in other parts of the lung, or the bacilli may be carried to the larynx, middle ear, or intestine. The primary lesion becomes a cavity and necrotic tissue that, after liquefaction, is expelled with coughing. If this lesion penetrates the pleura, a tuberculous pleural effusion will occur. The disease may spread via the lymphatics or blood vessels. Organisms that escape through the lymph nodes reach the bloodstream in small numbers, which sometimes.

One of the treatments that can be done to improve the condition of the arteries in coronary heart disease is to perform Coronary Artery Bypass Graft, which is an operation used to repair blocked and narrowed arteries by cutting and replacing the blocked arteries from healthy vessels called "grafts" taken from the legs, arms, or chest (Jain and Mistry, 2017). However, there are several complications that arise after Coronary Artery Bypass

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Graft is performed such as pulmonary complications. The pulmonary complications in question can be lung injury, atelectasis, pleural effusion, pneumonia, pneumothorax, gas exchange disorders, and will ultimately have an impact on decreasing lung functional ability (Çirak et al, 2015; Manapunsopee et al, 2020).

The decrease in lung functional capacity will be followed by a decrease in the value of maximal inspiratory pressure and maximal expiratory pressure, both of these values indicate a significant decrease in respiratory muscle strength after the Coronary Artery Bypass Graft procedure, which can increase mortality rates and length of hospital stay. The value of inspiratory muscle strength is an indicator that can describe lung functional capacity. Weakness in inspiratory muscle strength will certainly have an impact on the level of independence. Patients will quickly feel tired, short of breath, reduced activity, and can cause sputum retention (Stein et al, 2009; Manapunsopee et al, 2020).

To prevent and control these pulmonary complications, physiotherapy treatment is carried out in the form of exercises aimed at increasing the strength of the inspiratory muscles with chest physiotherapy. One of the chest physiotherapy methods that can be used is the Active Cycle of Breathing Technique, an active breathing technique performed by the patient to help remove secretions from the bronchi. The general cycle of the Active Cycle of Breathing Technique involves breathing control, expansion training, and huffing techniques. The amount and frequency of each component of the Active Cycle of Breathing Technique can be changed, but all components of the cycle must be applied and varied with respiratory control. This technique has been shown to be effective in mobilizing and clearing excess bronchial secretions and improving lung function. Lungs (Maria W. Lamuvel, 2016; Derakhtanjani et al, 2019; Naseer et al, 2019). This evidence-based case study aims to determine the effectiveness of Active Cycle of Breathing Technique in improving lung functional ability in post-Coronary Artery Bypass Graft patients compared to other chest physiotherapy methods.

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2. Research Methods

The search for scientific publication articles was conducted online using the Patient method: Post ACBG; intervention: active cycle of breathing technique; comparison: other physiotherapy interventions; outcome: functional lung capacity. The search instruments used were Pubmed and Google scholar. The keywords used were Coronary Artery Bypass Graft and Active Cycle of Breathing Technique, using the following limitations: studies conducted on humans, English publications, keywords in the title or abstract, year of publication from 2019 to present, and types of publications in the form of clinical trials, randomized clinical trials, meta-analyses, and reviews.

Using the search method explained above, 35 articles were obtained that met the criteria. Further searches were carried out manually on the relevant bibliography. After searching the titles and abstracts of the articles, 9 articles were found to meet the inclusion criteria. Then the search stage was continued by reading the entire article and 2 appropriate articles were found on Pubmed and 9 articles on Google Scholar.

3. Results and Discussion

a. Results

Undergo a physiotherapy program one day after surgery. From the results of the physiotherapy examination, it was found that the patient was asleep in bed, had compost mentis consciousness, and could communicate well. In this condition, a 1 liter nasal cannula was installed, a WSD was installed, a syringe pump was installed, and an IV was installed. Currently, the patient is able to transfer from sitting to a 45o sitting position with the help of 1 person, ambulation cannot be done yet. Thoracoabdominal breathing movements, the chest is symmetrical in the upper, middle, and lower parts. However, there was a decrease in chest expansion in the middle and lower parts. There was pain in the shoulder region in all movements. There was sputum retention in the anterior apical lower lobe dexttra segment. The six-minute walking test showed a result of 167.6 meters.

There are various clinical problems that arise due to coronary artery bypass graft. Physiotherapy is one of the efforts to eliminate this problem. Choosing the right

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exercise can help reduce the complaints experienced by patients. Based on this, the following clinical question is asked: "Can the provision of Active Cycle of Breathing Technique improve the functional ability of the lungs in post coronary artery bypass graft patients?" To answer the clinical problem of the case above, a scientific literature search was conducted, with the following results:

A study conducted by (Muthukumar, 2018) on 15 coronary artery bypass graft patients showed that active cycle of breathing technique can improve lung functional ability on the fifth to ninth day post coronary artery bypass graft. The evaluation methods used include the 6-Minute Walk Test (6MWT) to assess the scale of shortness of breath, the Visual Analog Scale (VAS) for the pre and post coronary artery bypass graft pain scale, and a thoracic expansion examination.

The VAS results showed a decrease in pain, pre-operative patients with an average VAS result of 8.3, and post coronary artery bypass graft with active cycle of breathing technique the average VAS result was 1.6. Pre-operative patients with an average Borg Scale result of 5.4, while post coronary artery bypass graft with active cycle of breathing technique the average Borg Scale was 1.4. active cycle of breathing technique has an effect on increasing respiratory depth, muscle strength and oxygenation, where all three are part of the mechanism used to reduce dyspnea and improve quality of life. The results of thoracic expansion examination, pre-operative patients showed an average result of 2.1 cm, and post coronary artery bypass graft with active cycle of breathing technique the average result was 2.7 cm.

The results of a comparative study conducted by Ahmad S. et al (Derakhtanjani et al., 2019), also showed that active cycle of breathing technique and routine chest physiotherapy interventions had the same effect on reducing pain, this was evidenced by a p-value of 0.001 which means that active cycle of breathing technique and routine chest physiotherapy showed a significant effect on reducing pain in post-coronary artery bypass graft patients.

The results of another comparative study conducted (Jain and Mistry, 2017) on 30 coronary artery bypass graft patients showed that active cycle of breathing

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technique and Incentive Spirometry (IS) had an effect on changes in Respiratory Rate (RR) and Breath-Holding Time (BHT). This is indicated by the p-value for changes in RR of 0.001, and changes in BHT of technique and IS interventions have a significant effect on changes in RR and BHT in post coronary artery bypass graft patients.

Another study cited from Maria W. et. al (Maria W. Lamuvel, 2016) on 60 coronary artery bypass graft patients (aged 41-75 years) who were grouped into two types of interventions. Group one contained 30 coronary artery bypass graft patients with active cycle of breathing technique intervention, and group two contained 30 coronary artery bypass graft patients with IS and mobilization intervention. The results showed that active cycle of breathing technique can improve oxygenation in the arteries on the first day post coronary artery bypass graft.

b. Discussion

Changes in lung function resulting from cardiovascular surgery have been documented in several studies. These changes in lung function can have a negative impact on the patient's condition after surgery. Chest physiotherapy is very necessary to be applied in this condition, one of the therapy methods that can be used is the Active Cycle of Breathing Technique, an active breathing technique that aims to help cough effectively, remove sputum retention, increase thoracic expansion, and improve lung ventilation (R and Muthukumar, 2018). The provision of active cycle of breathing technique intervention in coronary artery bypass graft patients is carried out with the patient in a sitting position, with the back completely straight with the help of a backrest.

Next, the patient is asked to do a long expiration slowly, without forcing it, 5 to 7 times to gain breathing control. After that, the patient is asked to take a deep breath with the mouth closed, and hold the breath for 3 to 4 seconds, called the thoracic expansion stage. The next stage is the patient is asked to huff 2 to 3 times and cough 2 to 3 times. When coughing, the patient places one of his hands on the incision site. This cycle is repeated at least twice and a maximum of three times in one therapy session (Jain and Mistry, 2017).

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Active cycle of breathing technique can be given as an intervention on the first day after coronary artery bypass graft when in the Intensive Care Unit, then active cycle of breathing technique is also given to coronary artery bypass graft patients who have entered the inpatient room for airway clearance (Çirak et al., 2015).

Active cycle of breathing technique can significantly increase arterial oxygenation and PaCO2 values in one exercise session, proving that this exercise can have a direct effect on alveolar ventilation. Improvement in ventilation can be seen from the decrease in respiratory rate (RR) and Borg scale. Deep breathing techniques performed during one cycle of active cycle of breathing technique can stimulate airflow between lung secretions, making it easier to mobilize secretions and improve ventilation. This improvement can also be seen from the increase in FEV1 and VC values by 34-72%. active cycle of breathing technique will result in increased transpulmonary pressure causing the lungs to expand and the lung units to collapse. The increased transpulmonary pressure will forcefully create space in the adjacent alveoli (Maria W. Lamuvel, 2016).

In one cycle of active cycle of breathing technique there is also an exercise to increase thoracic expansion when holding the breath, this phase will have an impact on increasing air flow to the area of obstruction, and improving air ventilation. Increased thoracic expansion in breathing exercise is associated with a decrease in collapsed lung units so that active cycle of breathing technique can increase thoracic expansion, and prevent collapse of lung units (Jain and Mistry, 2017). In addition, the forced expiration or huffing phase in the active cycle of breathing technique is in the form of dynamic compression and collapse of the airway to the mouth from the same pressure point. This phase can help remove sputum retention and stimulate the cough reflex. The loss of sputum retention is also associated with improved oxygenation so that it can reduce the process of atelectasis and increase maximum air ventilation.

In an effort to improve lung functional ability, active cycle of breathing technique can be combined with early mobilization exercises. The effectiveness of providing active cycle of breathing technique in an effort to improve lung function

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can be evaluated with a 6-minute walking test. The 6MWT distance is measured before and after surgery, with the administration of active cycle of breathing technique in the early phase of coronary artery bypass graft giving a result of 83% of the 6MWT distance before surgery can be achieved (Manapunsopee et al, 2020).

4. Conclusion

Active Cycle of Breathing Technique exercise has been proven to improve the functional ability of post coronary artery bypass graft lung patients by reducing pain, shortness of breath, sputum retention, increasing thoracic expansion, and pulmonary ventilation. This is proven by evaluation methods such as 6-Min Walk Test, Visual Analog Scale, Borg scale, thoracic expansion examination, respiratory rate examination and breath holding time.

5. Compliance with ethical standards

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Disclosure of conflict of interest

This research collaboration is a positive thing for all researchers so that conflicts, problems and others are absolutely no problem for all writers.

Statement of informed consent

Every action we take as authors is a mutual agreement or consent.

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