

Effects of Chest Physiotherapy and Effective Cough Exercise on Sputum Clearance and Respiratory Frequency in Tuberculosis Patients

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ABSTRACT

Background: Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*. Chest physiotherapy and cough exercises are one of the commonly used methods as part of TB treatment. This study aimed to determine the effects of chest physiotherapy and cough exercises on sputum clearance and respiratory frequency in TB patients.

Subjects and Method: This was a quasy experiment study with no control group. The study was conducted at Dungus Respiratory Hospital, Madiun, East Java. A sample of 26 TB patients was selected purposively. The independent variables in the study were effective cough and chest physiotherapy. The dependent variable in this study was sputum discharge. Chest and cough physiotherapy interventions are effective in patients 3 times. This study used a measuring instrument in the form of a sputum glass. The data collected were analyzed quantitatively using the Mann-Whitney test to determine the effect of chest physiotherapy and effective cough exercises on pulmonary tuberculosis conditions.

Results: After combination interventions of chest physiotherapy and effective cough exercises, sputum released (Mean= 29.35; SD= 0.85) was higher than before (Mean= 23.65; SD= 0.68). Respiratory frequency after intervention (Mean= 25.88; SD= 0.73) was higher than before (Mean= 27.12; SD= 0.98).

Conclusion: Sputum secretion and respiratory frequency are higher than before chest physiotherapy and cough exercises in TB patients.

Keywords: chest physiotherapy, cough exercise, physiotherapy, tuberculosis.

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BACKGROUND

Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*, a bacterium with a size of 1-5 micrometers (Versitaria and Kusnopranto, 2011). According to WHO, pulmonary tuberculosis

(Pulmonary TB) is a world health problem that is difficult to control, especially in developing countries. WHO estimates that one-third of the world's population is infected by TB which causes approximately 2 million deaths per year (Susanti, 2013).

Indonesia is ranked third after India and China in contributing TB in the world. Although efforts to eradicate pulmonary TB have been carried out, the incidence and prevalence of pulmonary TB in Indonesia have never decreased (Djojodibroto, 2009). From 2007 to 2012, the proportion of new BTA-positive patients in Indonesia has not reached the expected target although it is not too far below the minimum target (65%). As many as 21 out of 33 provinces (63.6%) have achieved the target of at least 65% (Ministry of Health, 2013).

The main disorder felt by patients with pulmonary TB cases is the lack of oxygenation (Price and Standridge, 2006). Meeting oxygenation needs includes ineffective breathing patterns, airway clearance, and impaired gas exchange. Airway clearance, namely the inability to clear secretions or obstructions of the respiratory tract to maintain a clean airway, with characteristic limits: dyspnea, additional breathing sound, changes in breathing rhythm and frequency, absent or ineffective cough, difficulty vocalizing, decreased breath sounds, orthopnea, anxiety, sputum (Wilkson, 2006).

Chest physiotherapy and cough exercises are one of the commonly used methods as part of tuberculosis treatment. Chest physiotherapy is a series of physiotherapy measures consisting of percussion, vibration, and postural drainage. Effective coughing is a body defense mechanism that functions to remove foreign objects or secretions that are a lot in the respiratory tract. This study aims to determine the amount of sputum and respiratory secretion before and after chest physiotherapy intervention and effective cough in pulmonary tuberculosis patients.

SUBJECTS AND METHOD

1. Study Design

This was a quasy experiment with no control group. The study was conducted at Dungus

Respiratory Hospital, Madiun, East Java, from July to August 2023. Patients with pulmonary tuberculosis conditions are given chest physiotherapy intervention and effective cough 3 times. Measurement amount of sputum secretion and frequency of breathing performed before and after the administration of chest physiotherapy intervention and cough is effective.

2. Population and Sample

The study population was TB patients at Dungus Madiun Lung Hospital. A total of 26 TB patients was selected using purposive sampling. The inclusion criteria was TB patients who experienced sputum buildup and never received effective cough exercises, or postural drainage with chest physiotherapy.

3. Study Variables

The independent variables in the study were chest physiotherapy and cough were effective. The dependent variable in this study was sputum discharge.

4. Conceptual Definition

Effective coughing: is a method of coughing correctly, where patients can save energy so that they are not easily tired and can remove phlegm to the maximum.

Chest Physiotherapy: passive and active therapeutic efforts such as irradiation, relaxation, postural drainage, percussion, vibration cough exercises, breathing exercises, and attitude correction.

5. Study Instruments

The amount of sputum removed using a measuring cup was measured before and after intervention in the form of chest physiotherapy and the effective cough was 3 times. Measurement of the amount of sputum and frequency of breathing was carried out 2 times before and after the administration of physiotherapy intervention and effective cough.

6. Data Analysis

The data collected were analyzed quantitatively using the Mann-Whitney test to deter-

mine the effect of chest physiotherapy and effective cough exercises on pulmonary tuberculosis conditions.

7. Research Ethics

A letter of approval for a research ethics permit was obtained from the Research Ethics Committee of the University of Muhammadiyah Surakarta with No. 4826/B.2/KEPK-FKUMS/V/2023.

RESULTS

1. Sample Characteristics

The subjects in this study were 26 patients consisting of 15 men (57.6%) and 11 (42.3%). In measuring sputum before treatment (pre-test) obtained a minimum value of 1.5 / ml and a maximum of 4.1/ml. The measurement of breathing/respiration before treatment (pre-test) obtained a minimum value of 18 times and a maximum of 22 times. This can be seen in Table 1.

2. Bivariate Analysis

Pre-test and post-test difference tests use non-parametric statistical tests in the form of The Mann-Whitney test. The Mann-Whitney test results in Table 2 show that sputum released by tuberculosis patients before chest physiotherapy intervention and cough training was effective (Mean= 23.65; SD= 0.68) was lower than after the intervention (Mean= 29.35; SD= 0.85) and the result statistically significant (p<0.050). The results of the Mann-Whitney test in Table 3 show the frequency of breathing in tuberculosis patients before the intervention of chest physiotherapy and effective cough training (Mean= 27.12; SD= 0.98) was higher than after the intervention (Mean= 25.88; SD= 0.73) and the result is statistically significant (p<0.050).

Table 1. Characteristics of research subjects at Dungus Lung Hospital Madiun (n=26)

Variables	Mean	SD	Min.	Max.
Sputum before intervention (ml)	23.65	0.68	1.50	4.20
Respiratory rate before intervention	27.12	0.98	18.00	22.00
Sputum after intervention (ml)	29.35	0.85	1.90	4.30
Respiratory rate after intervention	25.88	0.73	18.00	22.00

Table 2. The effect of chest physiotherapy and cough exercises are effective on sputum tuberculosis patients

Sputum	Mean	SD	p
Pre Intervention	23.65	0.68	< 0.050
Post Intervention	29.35	0.85	

Table 3. The effect of chest physiotherapy and cough exercises is effective on the frequency of breathing of tuberculosis patients

Sputum	Mean	SD	p
Pre Intervention	27.12	0.98	< 0.050
Post Intervention	25.88	0.73	

DISCUSSION

In this study, it was obtained sputum results released by tuberculosis patients before chest physiotherapy intervention and cough exercises were effective (Mean= 23.65; SD=

0.68) was lower than after the intervention (Mean= 29.35; SD= 0.85) and the result is statistically significant (p<0.050). Physiotherapy can increase the volume discharge of the sputum. Sputum reduction is material

that is removed from the lower airway by coughing. Sputum discharge occurs due to the mechanism of the mucous membrane that is stimulated so that mucus is removed with high intrathoracic and intra-abdominal pressure (Noorhidayah, 2015).

The findings in this study are in accordance with research conducted previously by Beteman et al. (2013) which states that physiotherapy can help accelerate peripheral lung clearance in tuberculosis patients. This study is in line with another study by Soemarno et al (2005), who stated that inhalation therapy interventions and Chest Physiotherapy (Postural Drainage, huffing, coughing, tapping, and clapping) were very significant in increasing sputum volume expenditure with a value of ($p= 0.001$) which means there was a very significant change in sputum volume as well.

Effective cough interventions also help in the discharge of sputum. When coughing, sputum will tend to come out easily, this is because the air that comes out with rapid acceleration and carries buried sputum. The sputum will come out more with an effective cough because effective coughing is done by coughing strongly 2 times so that the sputum that does not come out when coughed first can come out when coughed the second. This effective cough serves to remove secretions and particles in the pharynx and airway (Yosep, 2011).

Effective coughing itself aims to expel secretions and particles in the pharynx and airway. This effective cough is also effective for people with pulmonary tuberculosis. Based on the results of research conducted at the hospital. Lung Dungus Madiun shows that tuberculosis patients who do effective cough exercises find it easier to remove sputum than patients who do not exercise (Christianthus, 2010).

The results of a previous study by Sabatani (2011) also found a similar thing,

namely the effectiveness of chest physiotherapy in the form of postural drainage on the removal of sputum tuberculosis patients at the Bringin Health Center, Semarang Regency ($p = 0.001$). In addition to helping the removal of sputum and postural drainage, by doing chest physiotherapy, can affect the effectiveness of airway clearance with a value ($p = 0.001$) Tampubolon Research (2012). This is following the results of this study. Respiratory frequency in tuberculosis patients before chest physiotherapy intervention and cough exercises were effective (Mean=27.12; SD=0.98) was higher than after the intervention (Mean= 25.88; SD= 0.73) and the result is statistically significant ($p<0.050$).

Giving chest physiotherapy can help cleanse and remove the secret and loosen the airway. In the theory by Apriyadi (2013), cough is effective in medical circles as a therapy to remove mucus or secret that clogs the respiratory tract due to several diseases. Chest physiotherapy itself can be done to remove secretions from small and large airways so that secretions can be removed. Effective coughing is a method of coughing correctly, where patients can save energy so that they are not easily tired and remove phlegm to the maximum. Effective coughing can facilitate the release of secretions attached to the airway. Effective chest and cough physiotherapy does not require a large area and expensive tools making it easy to apply especially to tuberculosis patients, so this intervention can be used as one of modality for the treatment of tuberculosis.

The conclusion of this study is that effective coughing and chest physiotherapy can overcome the ineffectiveness of airway clearance in reducing the level of shortness of breath. There are limitations in this study such as the lack of intervention time because on average 1 patient gets physiotherapy treatment 3 times in the form of effective

chest and cough physiotherapy, patient motivation and medication are factors that have not been controlled by the therapist.

AUTHOR CONTRIBUTION

Yoga Handita is the main researcher who contributes to the selection of research topics, and implementers of research activities, collects research data and compiles research articles. Nur Basuki and Nurul Fithriati Haritsah contributed to analyzing research data, reviewing research documents, and assisting in following research articles until the articles can be published in journals.

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CONFLICT OF INTEREST

There was no conflict of interest in this study.

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