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PHYSIOTHERAPY MANAGEMENT OF BREATHING EXERCISE AND MOBILIZATION OF THE THORAX CAGE IN CASES OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD): A CASE STUDY

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Abstract

Introduction : Chronic Obstructive Pulmonary Disease (COPD) is a disease with persistent respiratory symptoms and chronic airflow limitation due to significant exposure to noxious particles or gases combined with a variety of host factors including genetics, airway hyperresponsiveness, and poor lung growth during childhood. The purpose of this study was to determine the effectiveness of breathing exercise combined with mobilization of the thorax cage on increasing activity tolerance.
Case Presentation : A 65-year-old man with history of COPD presented with severe shorthness of breath, chest pain and cough with difficulty in expelling phlegm. The patient had smoking history and hypertention. The spirometry examination result showed the FEV_1 prediction was 50%.
Management and Outcome : The treatment used in this study were breathing exercise combined with mobilization of the thorax cage. The evaluation result showed from day 1 to day 4 there were BORG scale from 5 to 2, CAT scale from 33 to 11, mMRC scale from 4 to 2 and there was significant improvement from thorax expansion.
Discussion : Breathing exercise combined with mobilization of the thorax cage decreased the sensation of dyspnea patient with COPD and improved the thorax expansion by loosened the airway and increased the upper-limb joint range of motion.
Conclusion: Breathing exercise combined with mobilization of the thorax cage has positive impact on improved exercise/activity tolerance patient with COPD.

Keyword: COPD, Breathing Exercise, Mobilization of the thorax cage, Physical Therapy

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a disease with persistent respiratory symptoms and chronic airflow limitation due to significant exposure to noxious particles or gases combined with a variety of host factors including genetics, airway hyperresponsiveness, and poor lung growth during childhood[6]. It is characterised by progressive airflow limitation due to inflamed and narrowed of bronchial tubes[6]. Chronic inflammation changed the lungs structure, narrowed the airways due to mucus and decreased the lung elasticity, so in the expiration process the ability of the airway to remain open was decreased[6].

COPD is a major cause of morbidity and mortality worldwide. According to WHO, 2020 the third leading cause of death in the world with 3.23 million deaths in 2019 was Chronic Obstructive Pulmonary Disease (COPD) and more than 80% occurred in low and middle income countries (LMIC)[17]. The disease often presented with symptoms of cough, dyspnea, and sputum production which is most often caused by cigarette smoke[6].

According to GOLD, 2019 there were multiple key indicators increased the probability to established a diagnosis of COPD before the examination using spirometry such as progressiveness dyspnea, intermitten chronic cough with recurrent wheezing, chronic sputum production, host factors (such as genetic factors, congenital/developmental abnormalities, etc.), tobacco smoke (including popular local preparations), smoke from home cooking and heating fuels, occupational dust, gases and other chemicals, and the last is a family history of COPD and/or childhood factors (eg. low birthweight, childhood respiratory infection etc)[6].

Physiotherapy has various treatment for patient with COPD there were Breathing Exercise and Mobilization of the thorax cage (active upper limb exercise). The first Breathing exercise intervention used in this study was Breathing control that aim to relaxed the airways and relieved the symptoms of wheezing and shortness of breath that usually occured after cough[3,5]. The second was Pursed-lip breathing which aims to managed tachypnea and relieved shortness of breath[9,10]. The third was deep breathing exercise combined with mobilization of the thorax cage (active upper limb exercise) which focused on inspiration and helps loosened secretion in the lungs and to increased thoracic expansion[7,8,11]. The purpose of this study was to determine the effectiveness of breathing exercise combined with mobilization of the thorax cage on increasing activity tolerance patient with COPD.

Case Presentation

A 65-year-old man with history of COPD presented with severe shorthness of breath, chest pain and cough with difficulty in expelling phlegm. The patient described shortness of breath having an intensity of 5 (severe) measured using the BORG scale, when the pain worsened he felt dizzy and nauseous. The patient had smoking history and hypertention. He had a productive cough for more than 3 months and was only treated by taking medicine without going to the hospital. This problem began to develop one year ago when he was working in the fields, he felt his chest hot and sometimes accompanied by pain and mild shortness of breath. In April 2021, his shortness of breath worsened and he underwent an examination at the hospital. On examination in the emergency department, the patient was afebrile. He looked a little protracted and had a barrel chest shape. The blood pressure 140/80 mmHg, heart rate was 130 per minute, respiratory rate was 35 per minute, SpO2 99% with nasal cannula installed, and body temperature was 36.7'C. The next examination was the chest x-ray, the result showed that the heart size was enlarged (cardiomegaly), the right and left hemidiaphragm looked good, the bone system looked good, the lungs did not show infiltrates/nodules, the hilum was not thickened, mild cephalization and last the right and left phrenicocostal angles were visible sharp. The spirometry examination result showed the FEV_1 prediction was 50%. The results of the CAT (COPD Assessment Test) showed a very high result with a score of 33. The mMRC (Modified Medical research Council) score was 4, the patient breathless when dressing or leaving the house. The measurement of thorax expansion during inspiration-expiration using metline also done in this study, the result showed from above or axilla showed a difference 1 cm, ICS (Intercostal space) 4 was 0,8 cm and last xiphoid process was 0,6 cm. From those examinations, the patient underwent inpatient treatment at a hospital in Madiun, East Java and was diagnosed with COPD.

Management and Outcome

The patient undertook a course of physiotherapy treatment consisting breathing exercise and mobilization of the thorax cage (active upper limb exercise). Breathing exercises given consist of breathing control, pursed-lip breathing and deep breathing exercises which are given differently for each session. This is done according to the patient's condition at each meeting session. Treatment given on the first day until day four when the patient is hospitalized. The treatment plan is listed in Table 1.

Table 1. Treatment Plan

Session	Vital Sign	Treatment
Day 1	BP : 140/80 mmHg HR : 130 x/minute RR : 35 x/minute SpO_2 : 99% (nasal cannula installed) T_1 : 36,7'C	**-Breathing Control** F :3 x/day I : according to patient tolerance T_2 : 5 minutes T_3 : relaxation **-Pursed-Lip Breathing** F : 3 x/day I : according to patient tolerance T_2 : 5 minutes T_3 : breathing exercise
Day 2	BP : 140/80 mmHg HR : 126 x/minute RR : 33 x/minute SpO_2 : 100 % (nasal cannula installed) T_1 : 36,7'C	**-Breathing Control** F : 3 x/day I : according to patient tolerance T_2 : 5 minutes T_3 : relaxation **-Pursed-lip Breathing** F : 3 x/day I : according to patient tolerance T_1 : 5 minutes T_2 : breathing exercise **-Active Upper Limb Exc.** F : 2 x/day I : moderate T_1 :10 minutes T_2 : stretching
Day 3	BP : 145/85 mmHg HR : 120 x/minute RR : 28 x/minute SpO_2 : 99 % (nasal cannula installed) T_1 : 36,6'C	**-Breathing control** F : 3 x/day I : according to patient tolerance T_2 : 5 minutes T_3 : breathing exercise **-Pursed-lip Breathing** F : 3 x/day I : according to patient tolerance T_2 : 5 minutes T_3 : breathing exercise **-Active Upper Limb Exc.** F : 2 x/day I : moderate T_2 : 10 minutes T_3 : stretching

Day 4	BP : 140/85 mmHg HR : 110 x/minute RR : 22 x/minute SpO_2 : 98% T_1 : 36,6'C	**-Breathing control** F : 3 x/day I : according to patient tolerance T_1 : 5 minutes T_2 : breathing exercise **-Deep Breathing Exc.** F : 3 x/day I : moderate T_2 : 5 minutes T_3 : breathing exercise **-DBE combined with Mobilization of the thorax cage (active upper limb exc.)** F : 3 x/day I : moderate T_2 : 10 minutes T_3 : breathing exc and mobilization thorax cage

Abbreviations : BP, Blood Pressure; HR, Heart Rate; RR : Respiratory Rate; SpO_2, oxygen saturation; T_1, Temperature (Body); DBE, Deep Breathing Exercise; F, Frequency; I, Intensity; T_2, Time; T_3, Type.

In addition to the treatment in the table 1, the patient also received other treatment in the form of administering drugs for bronchodilators and mucolytics using a nebulizer, as well as taking oral medications and injections. After 4 treatment sessions, measurements were taken and the results showed that there was a decrease in the BORG scale from 5 to 2, the CAT scale from 33 to 11, and the mMRC scale from 4 to 3. The spirometry examination result showed the FEV_1 prediction was 50%. The measurement of thorax expansion during inspiration-expiration using metline showed a good result, there was a significant improvement in axillary region from 1 cm to 2 cm, ICS 4 region from 0,8 cm to 1,5 cm and last xiphoid process region from 0,6 cm to 1,5 cm.

Discussion

Breathing control aims to relaxed the airways and relieved the symptoms of wheezing and shortness of breath that usually occured after coughing or shortness of breath[3,5]. The patient breathes as relaxed as possible without rushing according to a normal breathing rhythm, it's because usually after received nebulizer treatment the patient experienced a cough[1]. Pursed-lip breathing (PLB) was found to positively impact to increased tidal volume with reduction in respiratory rate, it suggests reduction in airway collapse, airway resistance and air trapping in the lungs patient with COPD[9,13,16]. Cabral et al[4] stated that PLB in COPD patients with low peak expiratory flow can reduced dynamic hyperinflation and improved exercise tolerance, breathing patterns and arterial oxygenation at submaximal intensity exercise. However, there is no definite basis for how long PLB should be carried out so that it can have a positive

impact on the sensation of dyspnea in COPD patients[16]. Deep Breathing Exercise specially improved coordination of diaphragm muscles, abdominal muscle and intercostal muscles[7]. By the load breathing training method, it enhanced the respiratory muscle strength, amplifying the thorax movement range, and magnified the diaphragm muscle distance moved to effectively expand the airway, reduced resistance, and improved breathing quality[7].

COPD patients commonly avoid or limit physical activities to avoid dyspnea which in turn it lead to decreased in exercise tolerance, increased in anxiety and disability and poor quality of life (QoL)[16]. Hyperinflation of the lungs in COPD patients leads to a remodeling of the inspiratory muscles that caused postural deformities such as elevated, protracted or abducted scapulae with medially rotated humerus, and kyphosis that leads to further tightening of respiratory muscles[12,14]. As the severity of the disease progresses, use of the upper limbs for functional tasks becomes difficult due to muscle stiffness[12]. COPD patients need to do active upper limb exercise because it has been proven that active exercise can improve muscle function and tolerance to exercise/activity, so it can improved the joint range of motion[15]. Breathing exercise combined with mobilization of the thorax cage decreased the sensation of dyspnea patient with COPD and improved the thorax expansion by loosened the airway and increased the upper-limb joint range of motion.

This study has limitations, the subjects in this study also received other treatment in the form of administering drugs for bronchodilators and mucolytics using a nebulizer, as well as taking oral medications and injections. Those treatment may also has impact in loosened the airway by expelling the pleghm and dilated the broncho tubes. So further study is recommended to verify wether for breathing exercise and mobilization of the thorax cage for patient with COPD have impact to improve activity tolerance.

Conclusion

Breathing exercise has a positive impact on the sensation of dyspnea and respiratory rate management by loosened the airway. Active upper limb exercise strengthen the respiratory muscle and maintenance range of motion upper limb. The combination of the these two interventions can improved the quality of life patient with COPD by increased the exercise/activity tolerance and has positive impact on the sensation of dyspnea in COPD patients.

Acknowledgments

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