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A study to assess the effectiveness of diaphragmatic breathing exercise in COPD patients: A randomised controlled trial

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Abstract
Chronic Obstructive Pulmonary Disease (COPD) is an umbrella term used to describe progressive lung diseases including emphysema, chronic bronchitis, and refractory (non-reversible) asthma. This disease is characterized by increasing breathlessness. Researcher conclude that DBTP in patients with COPD leads to improvements in abdominal motion during NB and in functional capacity.

Keywords: assess, effectiveness, diaphragmatic breathing exercise, COPD

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is characterized by airflow limitation due to obstruction of airways. Due to peripheral airway obstruction, air volume may become trapped in the lungs (i.e. hyperinflation). The respiratory rate may increase because of inspiration, which is initiated before emptying the lungs of air. Adjustment of rapid shallow breathing may lead to respiratory muscles fatigue. Hyperinflation may lower the dome of the diaphragm, shorten respiratory muscle fibers and impair the possibility of muscle contraction In addition, gas exchange may be inefficient. Hence, patients with COPD might develop symptoms of breathlessness or dyspnea.

Respiratory rehabilitation programs for COPD including endurance exercise training that helps people build their physical fitness also teach people breathing techniques and strategies for living better with COPD.

One of the breathing techniques is diaphragmatic breathing (DB), also called abdominal or deep breathing that is done by contracting of diaphragm muscle which is dome-shape sheet of muscle located horizontally between thoracic cavity and abdominal cavity.

Diaphragmatic breathing has been claimed, but not demonstrated, to correct abnormal chest wall motion, decrease the work of breathing (WOB), dyspnea or short of breath (SOB) and improve ventilation but the physiological studies on the effects of the single components of pulmonary rehabilitation are lacking.

Some reports have shown diaphragmatic breathing to cause a significant increase in tidal volume, reduction in respiratory rate and improved breathing pattern and respiratory efficiency in COPD patients. An example of a COPD patient's perception of the utility of diaphragmatic breathing was, 'Diaphragmatic breathing has been extremely beneficial to my ability to function in daily life and to the quality of my personal, recreational and professional life'.

However, there is also a concern that in patients with severe COPD and asynchronous thoraco-abdominal motion, diaphragmatic breathing may actually cause an increase in dyspnoea and reduce the mechanical efficiency of breathing. Therefore, it is important to determine whether the effect of diaphragmatic breathing differs amongst participants with varying disease severity.

The use of diaphragmatic breathing in people with COPD remains controversial, but continues to be used in physiotherapy practice. Some studies of diaphragmatic breathing techniques have measured abdominal expansion to determine the effect on diaphragmatic function, but it is unclear whether abdominal movement is specific to diaphragmatic muscle activity – it is quite possible to expand the abdomen with minimal or no diaphragmatic involvement. Direct measurement of diaphragmatic muscle activity may therefore be a better outcome measure. The effect of nutritional status on the effects of positioning and diaphragmatic breathing is not known, but it is postulated that increased body mass index (BMI), which may be associated with increased abdominal adipose tissue deposition, could impact negatively on diaphragm activity and the potential to recruit diaphragmatic activity during diaphragmatic breathing.

distribution have been shown to be effective in patients with chronic obstructive pulmonary disease (COPD) and reported improvement in maximal exercise tolerance in mild COPD patients undergoing Diaphragmatic breathing (DB) and pursed-lip breathing, but not in matched control patients. On the other hand, uncontrolled studies revealed a decrease in rib cage motion and an increase in abdominal motion during DB while pulmonary function and exercise capacity remain unchanged.

Recently, in a study during loaded and unloaded breathing in patients with moderate to severe COPD without respiratory insufficiency, with almost normal inspiratory muscle strength, DB detrimentally affected coordination of chest wall motion as well as mechanical efficiency, while dyspnea sensation was not improved.

We wondered what might be the effects of that approach in more severe COPD patients, namely those with chronic respiratory insufficiency recovering from an episode of acute respiratory failure. Therefore, this study was undertaken to investigate the impact of deep DB on blood gases, breathing pattern, and dyspnea in severe hypercapnic

COPD patients with reduced inspiratory muscle strength, recovering from a recent exacerbation of their disease. In a smaller group of patients we also examined the effects of DB on pulmonary mechanics.

Various breathing control exercises (BCEs) and respiratory muscle training (RMT) are being used to improve breathlessness. For example, BCEs include diaphragmatic breathing (DB), pursed-lip breathing (PLB), relaxation techniques (RT), and body position exercises (BPEs). BCEs aim to decrease the effort required for breathing and assist relaxation by deeper breathing, which may result in an improved breathing pattern through decreased respiratory rate and reduced breathlessness.

This study aimed to examine the short-term effect of deep diaphragmatic breathing on respiratory muscle activity (diaphragm and intercostal muscles) in patients with COPD

2. Methodology

The design of this study will be a randomized control trial 30 male subjects will screened, among whom fifteen subjects for each group, study group will selected for inclusion in the study. 1) Age from 40 to 60 2) The selected subjects have a documented medical history of COPD, receiving medical therapy with pulmonary drugs, 3) Smokers or former smokers, and none have any clinical or physiological features of bronchial asthma.

The exclusion criteria 1) age over 80 years 2) obesity 3) history of recent exacerbation 4) uncontrolled arterial hypertension 5) Need for home oxygen therapy.

Diaphragmatic breathing exercises will be done for study group only the control group under medical treatment only Measurement (blood gases O%, PaO2, PaCO2 and PaO2/FiO2)

Setting-Govt Hospital Gonda, Uttar Pradesh.

3. Results

Ninety-four patients were assessed for eligibility and 30 patients were randomly assigned to groups. There were 3 protocol deviations in the CG because of either an acute COPD exacerbation or other health problems. These patients were retained to respect the intentionto-treat analysis. There was no difference between groups with regard to baseline values of disease severity, functional capacity, anthropometric data, or other baseline characteristics.

Thoracoabdominal and Diaphragmatic Mobilities Immediately after the 4-week DBTP, the TG showed a greater abdominal motion during NB quantified by a reduction in the RC/ABD ratio when compared with the CG (F8.66; P.001). Abdominal motion during voluntary DB after the intervention was also greater in the TG than in the CG (F4.11; P.05). DB competency was observed in all TG patients. Finally, the TG showed a greater diaphragmatic mobility after the 4-week DBTP than did the CG (F15.08; P.001). Effect sizes were medium to large in favor of the TG on the diaphragmatic mobility (d.46) and RC/ABD ratio during both voluntary DB (d –.69) and NB (d –96). The RC/ABD ratio and diaphragmatic mobility remained unchanged in CG patients.

Functional Capacity Dyspnea was lower in the TG after the 4-week DBTP compared with the CG (F5.1; P.05). An improvement in HRQOL for the TG was observed by a 10-point reduction in the total SGRQ score (F9.7; P.001). The benefits in different SGRQ domains (symptom and impact) for the TG were statistically significant compared with the CG, and they were also clinically relevant. However, no change in the TG was observed for the activity domain. Finally, after the 4-week follow-up period, the TG showed a better performance in the 6MWT compared with the CG (F4.9; P.05). Effect sizes were small to medium in favor of the TG on the 6MWT (d.31), dyspnea (d –.41), and HRQOL (d–.64). Spirometry values and lung volume data remained unchanged in both groups.

Linear Relationship between the Improvement in Abdominal Motion and Baseline Characteristics Improvement in abdominal motion (RC/ABD ratio) after DBTP was inversely related to the baseline RC/ABD ratio (r –0.8; P.001) and baseline diaphragmatic mobility (r.58; P.02). The bottom right area reveals that most patients who improved their abdominal motion had a baseline predominance of costal breathing (RC/ABD ratio 0.5). The patients with a lower baseline diaphragmatic mobility demonstrated a higher improvement in abdominal motion after DBTP. Changes in abdominal motion did not correlate with any other baseline outcomes in the TG. The RC/ABD ratio after a 4-week follow-up period was not related to the baseline RC/ABD ratio or baseline diaphragmatic mobility in the CG (P.05).

4. Discussion

This RCT was designed to investigate the isolated effects of a short term DBTP in patients with COPD. It demonstrated an improvement in abdominal motion during NB and voluntary DB, as well as an increase in diaphragmatic mobility. We also observed that DBTP leads to benefits in dyspnea symptoms, HRQOL and exercise tolerance. These results support the hypothesis that DBTP can induce a modification in habitual breathing patterns and increase diaphragmatic excursion, thereby relieving symptoms and improving the functional capacity of patients with COPD.

Results demonstrate that during voluntary DB, patients were able to increase abdominal motion, which is consistent with previous findings. In addition, we also showed that patients with COPD who completed DBTP demonstrated an increase in abdominal motion during NB. However, Gosselink et al did not report permanent changes in abdominal motion after the diaphragmatic learning period, suggesting that DB patterns may not be adopted naturally. Our study includes some methodological differences that might elucidate the discordance in results between our study and Gosselink's study.

First, our training program was longer (12 session's vs 9 sessions). Second, in their study, DB was performed only in the supine and sitting positions, while in our program, DB was also performed in the lateral decubitus and standing positions.

Third, our patients had less airflow obstruction compared with those studied by Gosselink (43% vs 34% FEV1). Finally, all our patients were considered competent to perform DB after the intervention, whereas no description of DB competency was provided in the other study. All those differences between the studies could explain the benefit observed in our patients.

Diaphragmatic dysfunction is an important consequence of respiratory alterations in patients with COPD. We have previously reported that patients with reduced diaphragmatic mobility (33.99mm) have a lower exercise tolerance and increased dyspnea after physical effort. In the present study, patients from both groups had an impairment of diaphragmatic mobility at baseline, evidenced by a lower excursion than the critical point for diaphragmatic dysfunction (33.99mm) and only patients who participated in DBTP showed improvement in diaphragmatic mobility beyond the point of impairment. Based on these findings, the increase in diaphragmatic mobility is expected to improve dyspnea symptoms and functional capacity.

It has been demonstrated that both increased activity of chest wall respiratory muscles and the impairment of diaphragm activity are associated with higher sensations of dyspnea. This suggests that interventions aimed at reversing the extensive use of chest wall respiratory muscles and enhancing diaphragmatic function might alleviate dyspnea in patients with COPD. Our results reveal that patients who participated in DBTP had higher abdominal motion during NB and higher diaphragmatic mobility after the training, as well as a reduction in dyspnea symptoms. Based on these findings, we can speculate that the reduction in dyspnea could be at least partially explained by a higher participation of the diaphragm and a lower activity of chest wall respiratory muscles.

5. Conclusions

Researcher conclude that DBTP in patients with COPD leads to improvements in abdominal motion during NB and in functional capacity. Reaearcher also showed that patients with a baseline level predominance of costal breathing and worse diaphragmatic mobility experienced a greater improvement in abdominal motion. These patients are probably stronger candidates for DB training. Therefore, this study underscores the importance of DB as an adjunctive treatment modality for patients with COPD.

6. References

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