

# SHORT-TERM EFFECTS OF CHEST PHYSIOTHERAPY IN ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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## ABSTRACT

**Objective:** To find out the short-term effects of chest physiotherapy in acute exacerbation of Chronic Obstructive Pulmonary Disease (COPD)

**Material and Methods:** The total 60 patients suffering from Chronic obstructive Pulmonary disease were randomly allocated into two groups, experimental group (n=30) treated with active chest physiotherapy techniques along with medical treatment and control group (n=30) treated with only medical treatment. Both groups were assessed using visual analogue scale (VAS) for breathlessness, Peak Expiratory Flow Rates (PEFR) and Oxygen saturation level (SaO<sub>2</sub>) before and after 2 weeks treatment program.

**Results:** Patients in both the groups reported significant improvement after 2 weeks of treatment program compared to baseline on all outcome measures except PEFR that was not significantly improved in control group. Compared to control group, experimental group showed more improvement on PEFR (P<0.05), SaO<sub>2</sub> (P>0.05) and on VAS for breathlessness (P<0.05). It was about three times better results over the control group.

**Conclusion:** Active chest physiotherapy technique along with medical treatment is more effective in acute exacerbation of COPD than medical treatment alone

**Key Words:** Active Chest Physiotherapy, Acute Exacerbation of COPD, Active Cycle of Breathing Technique, Visual Analogue Scale for breathlessness.

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## INTRODUCTION

The chronic respiratory diseases contribute 7% of all chronic illnesses that ultimately lead to death<sup>1</sup>. Chronic obstructive pulmonary disease (COPD) is the common cause of chronic respiratory disease and is the 4th leading cause of death worldwide<sup>1-2</sup>. Estimated 6-7 millions population of Pakistan are also suffering from COPD (commonly chronic bronchitis)<sup>3</sup>. Mortality rate due to COPD in Pakistan is 71 deaths per 100,000 population<sup>4</sup>. The airflow obstruction in COPD is generally

progressive with airway reactivity some times and only partially reversible<sup>5</sup>. The acute exacerbations of COPD are characterized mainly by increased sputum volume and purulence along with Shortness of Breath (SOB), fatigue and mood disturbances<sup>6</sup>. All these changes lead to the decline in physical activities and health-related quality of life<sup>7</sup>. Due to high morbidity and high mortality associated with COPD, the management focuses not only on medical treatment but stressing healthy life styles and encouragement for physical activities alongside to enhance the functional activity level and overall health related quality<sup>8</sup>.

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Chest physiotherapy is a crucial part of respiratory diseases management that facilitates removal of secretions from lungs, improving lung volumes, breathing re-education and respiratory muscle training. Chest physiotherapy includes active techniques, passive techniques and advanced techniques for improving

lung functions in many dimensions. Manual or Passive chest physiotherapy technique are percussion, vibration and postural drainage while active technique includes active cycle of breathing, autogenic draining and flutter devices<sup>9-10</sup>.

Previously the physiotherapy management of COPD only included mobility and transfer training while chest physiotherapy for improving the lung functions was less focused<sup>11</sup>. Theoretically removal of sputum from lung airways and strengthening of respiratory muscles through chest physiotherapy techniques can improve shortness of breath, oxygen saturation and overall quality of life in such patients. The practice of chest physiotherapy in COPD started since these techniques reported safe and effective in removal of secretion from lungs due to COPD<sup>12</sup>. Manual techniques/passive techniques considered less safe for COPD patients compared to active techniques due to its harmful effects like bronchospasm, atelectasis, arterial unsaturation and hemodynamic disturbances etc<sup>13</sup>.

The clinician frequently prescribes Active Chest physiotherapy Techniques (ACTs) for COPD patients on large-scale in clinical setups as reported by studies even with limited published literature about its effectiveness for COPD patients<sup>8,14</sup>. The literature proposed a need for interventional studies on effectiveness of ACTs in COPD management<sup>8,15</sup>.

Active Cycle of Breathing Technique (ACBT) which is a form of ACTs includes 1) deep breathing exercises, 2) thoracic expansion exercise and 3) forced expiratory technique. The ACBT corrects breathing pattern and it strengthen respiratory muscles with airway clearance, these all in a combination improves respiratory functions in COPD patients<sup>7</sup>. The literature on the use of ACTs in acute exacerbation of COPD reflected the shortage of well-designed Randomized Clinical Trials (RCTs), lack of control group, failure to enroll patients with large chest secretions and consistent use of inappropriate outcome measures<sup>12,16-17</sup>.

The RCT is therefore conducted with consideration of previously documented methodological flaws, to check the short-term efficacy of ACTs specifically of ACBT on lungs functions, oxygen saturation and level of breathlessness in acute exacerbation of COPD patients.

### MATERIAL AND METHODS

This was a double blinded RCT and was carried out on 60 patients with 30 patients in each group. Both of the study groups received medical treatment but one of the group (experimental group) received chest physiotherapy additionally. The trial duration was 2 weeks.

The ethical approval for the study was taken by Ethics Board of Khyber Medical University. Only those patients were enrolled who signed an informed consent, based on Helsinki ethical considerations. The data was initially taken by an independent assessor and then patients allotted by him into 2 groups randomly by making computer generated sequences. The physiotherapist only treated the patients with chest physiotherapy techniques and did not play a role in patient's assessment (for making the study blinded). The medical treatment was given independently to physiotherapy treatment.

The patients enrolled in the study on the following eligibility criteria. 1) Male and Females patients 2) 45-60 years age 3) Hospitalized patients diagnosed by a medical doctor as COPD with acute exacerbation as a primary diagnosis and chronic bronchitis as a secondary diagnosis 4) Patients with pronounced symptoms of sputum retention with coughing 5) ability to tolerate active techniques 6) well-oriented patients. The patients were excluded on following criteria 1) severe attack with longer expected hospital stay up-to >2 weeks 2) Cardiac or any other condition that contraindicated chest physiotherapy 3) COPD with secondary diagnosis of emphysema 4) any other associated lung pathological condition 4) pain with more than 2 points on visual analogue scale while doing active techniques 5) Patients with history of lung surgery.

The patients were assessed on inclusion and exclusion criteria by a medical doctor who was the part of the study. All the patients were treated at Medical wards of Fauji Foundation Hospital Peshawar. A previous medical history was taken for previous attacks of acute exacerbation and associated length of hospital stay. There were three outcome measures used in this study. The Peak Expiratory Flow Rates (PEFR) measured with help of peak flow meter, the oxygen saturation (SaO<sub>2</sub>) measured by the pulse oximeter and breathlessness level evaluated by 100 mm Visual Analogue Scale (VAS).

The experimental group was treated with chest physiotherapy along with medical treatment. The ACBTs was delivered to patients in the sitting comfortable position or half laying position on the hospital bed. The technique was applied in following steps:

1. Breathing control exercise: this step consisted breathe in through the nose and breathe out through pursed lips, while the abdomen was supposed to move up with inspiration and move down with expiration. The step repeated for 8-10 times.
2. Thoracic expansion exercises: this step consisted of full inspiration with holding air inside lungs for 1-3 seconds and then full end with pursed lips. It was performed 3-4 times on patients.

3. Forced expiration technique included 1-2 huffs followed by force full cough for 1 or 2 times. Step 1 was considered as a relaxation technique and used at any time for correction breathlessness. Total time taken for the whole procedure was 30-40 minutes with repetitions for this above steps 11.

Both the groups received medical treatment that mainly included bronchodilators, anti-inflammatory drugs, smoking cessation and other life style and diet modification. Patients in the experimental group were unaware that physiotherapy may create significant effects to their conditions (thus they were blind to the study).

**RESULTS**

The Means were computed for age and previous number of acute exacerbations. Descriptive statistic: The Mean age of the subjects in group A was  $53 \pm 3.7$  years while in group B Mean age was  $55 \pm 3.8$  years. The previous number of acute exacerbations of COPD for group A was  $3.0 \pm 0.84$  times and in Group B it was  $2.6 \pm 0.62$  times. The sample constituted of  $n=13$  men,  $n=17$  women in group A and  $n=18$  men,  $n=12$  women in group B.

The baseline Means of VAS, SaO<sub>2</sub> and PEFR of both the groups indicates that the patients were similar on baseline. (Figure 1 and Figure 2) The within group analysis for VAS, SaO<sub>2</sub> and PEFR was done using paired t-test in both control and experimental group. Control group: Reported Mean difference by paired t test in control group for VAS was  $0.40 \pm 0.63$  with  $P=0.03$  for PEFR

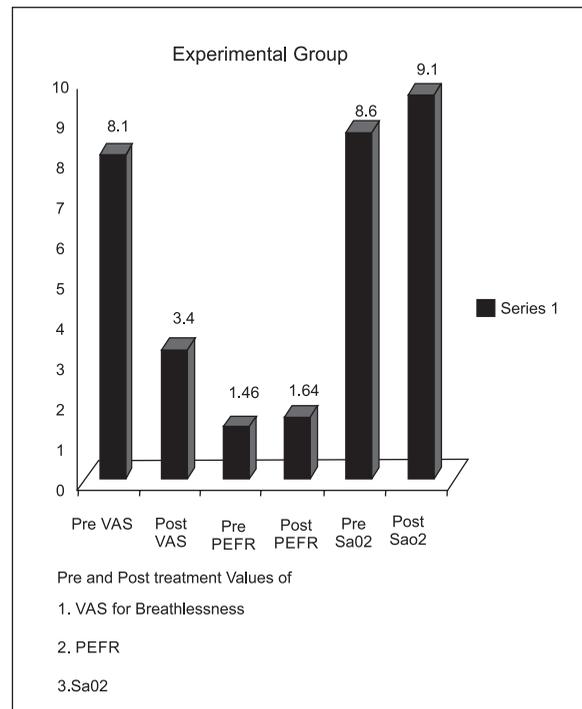


Figure 2: Means of VAS, PEFR and SaO<sub>2</sub> on baseline and after treatment (Experimental group)

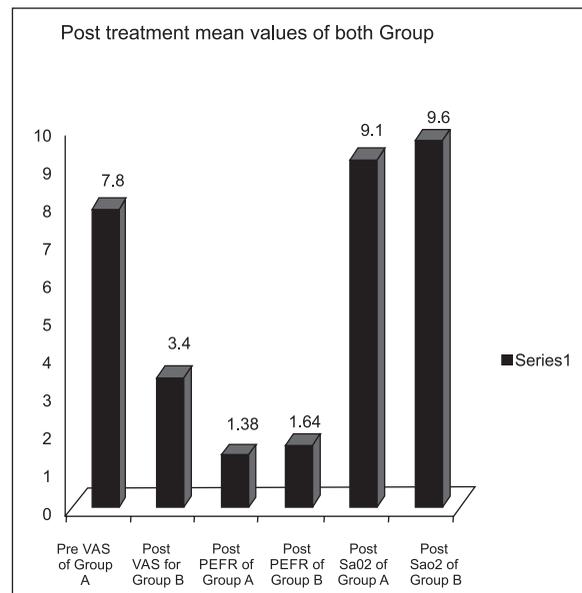


Figure 3: Means of VAS, PEFR and SaO<sub>2</sub> post treatment for control and experimental group.

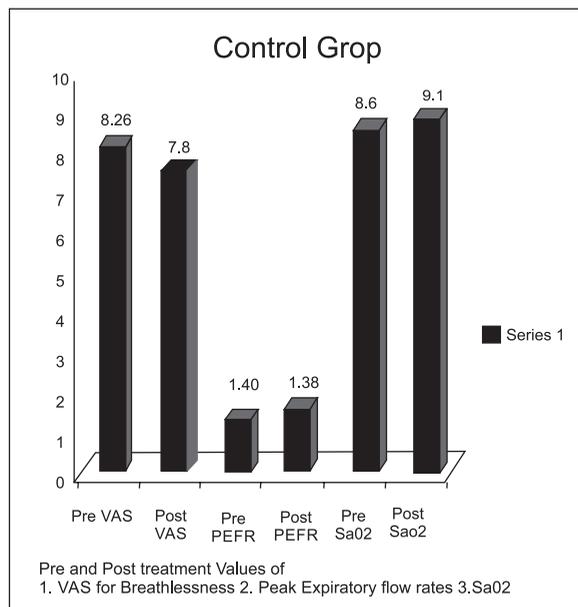


Figure 1: Means of VAS, PEFR and SaO<sub>2</sub> on baseline and after treatment (Control group)

$2.00 \pm 25.89$  with  $P=0.76$  and for SaO<sub>2</sub>  $-3.7 \pm 3.10$  with  $P=0.00$  using 95% CI. (Figure 1) Experimental group: Reported Mean difference by paired t test in experimental group for VAS for breathlessness was  $4.78 \pm 1.12$  with  $P=0.03$  for PEFR  $-5.35 \pm 5.35$  with  $P=0.02$  and for SaO<sub>2</sub>  $-3.64 \pm 3.20$  with  $P=0.01$  with 95% CI. (Figure 2) Using Independent t-test, the Mean difference for VAS, SaO<sub>2</sub> and for PEFR between groups (group A and B) using

the 95% CI was 1.53, -6.7 and -25.65 respectively with statistically significant value ( $p < 0.05$ ).

### DISCUSSION

The present study was conducted to strengthen the evidence regarding effects of chest physiotherapy in acute exacerbation of COPD. The research was about the effectiveness of ACBTs in COPD acute exacerbation. This study concluded for effectiveness for chest physiotherapy for COPD patients presented with acute exacerbation specially in improving peak expiratory flow rates. Smitha J and Aggarwal R et al conducted studies on similar aspect and both of them reported for significant improvement in experimental group (received chest physiotherapy with medical treatment) on SaO<sub>2</sub> and PEFR compared to control group received medical treatment only)<sup>7,18</sup>. One of the systematic reviews agreed for use of both active and passive techniques in acute exacerbation of COPD but did not favored it on large scale<sup>19</sup>.

The inconsistent results in that area may be due to the variety of outcome measures used and their relative sensitivity differences for chest physiotherapy techniques. Some researches claimed that chest physiotherapy techniques including airway clearance devices have not been deeply studied in COPD patients, as in cystic fibrosis. The physiological improvements in SaO<sub>2</sub> peak expiratory rates are associated with release of sputum from chest, deep penetration of alveolar air inside lungs and with correcting breathlessness and exercise endurance, these all can be carried out by chest physiotherapy techniques and these were mechanism considered for effectiveness of chest physiotherapy in cystic fibrosis<sup>20</sup>. In contrast, now there is rising evidence to support pulmonary rehabilitation during or shortly after an acute exacerbation of COPD<sup>17</sup>. A recent meta-analysis demonstrated significant evidence for improvements in exercise capacity and health related quality of life associated with chest physiotherapy after acute exacerbation of COPD. They also suggested pulmonary rehabilitation for patients who are clinically unstable<sup>21</sup>. The effective management for acute exacerbation of COPD is therefore demanded to expand the evidence with a focus on quality of life not only to recover from acute phase of the disease.

A prospective study carried out by Rosa et al on COPD in year 2006<sup>22</sup>. They followed patients for 12 months with one group received medical treatment only and another group received chest physiotherapy additionally. Their outcome measures were perception of dyspnea and chronic respiratory questionnaire. They

reported that patients can achieve worthwhile benefits through physiotherapy and these benefits can persist for 2 years almost<sup>22</sup>.

Some of the study limitations were following; as the data was collected from on study site and only on mild to moderate acute exacerbation of COPD so the result cannot be generalizable to more severe or chronic phases of the disease. Also the trial used only certain specific outcome measures as used by the previous trials and was lacking objective evaluations of patient's satisfactions and treatment compliance to exercise protocol. Future studies therefore needed to have larger sample size with extensive assessment tools to consider diversity in functional abilities of COPD patients. There is need to divide COPD subjects in subgroups with different severity level so the results would be generalizable to COPD population. There is need to objectively evaluate the COPD patients for treatment satisfaction and compliance especially in case of circuit based trainings.

### CONCLUSION

Chest physiotherapy is more effective in improving breathlessness level, SaO<sub>2</sub> and peak expiratory flow rates in acute exacerbation of COPD along with standard medical treatment than medical treatment alone. The estimated effects of chest physiotherapy in COPD patients are about three times more pronounced with medical treatment compared to medical treatment alone.

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### **AUTHOR'S CONTRIBUTION**

Following authors have made substantial contributions to the manuscript as under:

**Basri R:** Concept and Design, Acquisition of Data, final Approval

**Tahir M:** Data collection, Data Analysis,

**Naseem M:** Critical Review, Data Analysis

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.