

The Immediate Effect of Chest Mobilization Technique on Dyspnea in Patients of COPD with Restrictive Impairment

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Abstract

Objective of study: to relieve dyspnea in patients of COPD with restrictive impairment by chest mobilization technique. **Background:** COPD is a primary lung disease but as it advances, there is restriction in chest wall mobility which decreases pulmonary functions and vital capacity of lung. So purpose of this study is to assess the immediate effect of chest mobilization on relieving dyspnea by improving the oxygen saturation. **Materials and Methods:** an experimental study was conducted on 30 COPD patients having vital capacity <80%, to assess the pre and post differences in modified Borg scale by applying chest mobilization technique: rib rotation; lateral flexion, extension, rotation of chest wall and pectoralis major stretching. **Results:** for within group analysis, comparison of data for modified Borg score was done using Wilcoxon sign rank test, and for between groups analysis was done using Mann Whitney U test. Statistical analysis showed significant change in modified Borg score after application of chest mobilization technique. **Conclusion:** it can be concluded from this study that chest wall mobilization has significant effect on dyspnea in COPD patients who are having restrictive impairment of chest wall in later stage of disease.

Introduction

The term Chronic Obstructive Pulmonary Disease (COPD) refers to chronic disorder that disturbs airflow. COPD is a major cause of morbidity and mortality in INDIA (Singh et al, 2003). COPD is a preventable and treatable disease with some significant extra-pulmonary effects that may contribute to

the severity in individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases (Goldcopd, 2014). The common task force

statement of The American Thoracic Society (ATS) and The European Respiratory Society (ERS) adds to this definition that: "COPD is.....primarily caused by cigarette smoking."(Celli & MacNee, 2004). Both GOLD and ATS/ERS agree that COPD is to be suspected when there is a history of exposure to risk factors for the disease, chronic cough, sputum production and/or dyspnoea and that diagnosis must be confirmed by spirometry. When forced expiratory volume in one second (FEV₁) divided by forced ventilation capacity (FVC) is <70%, even after administration of a bronchodilator, the diagnosis is confirmed (Singh et al, 2003). In patients older than 70 years a somewhat lower ratio (< 65%) has been suggested. (Rabe et al, 2007). Some guidelines claim that besides FEV₁/FVC < 70%, the FEV₁ should be < 80% of predicted value for diagnosis of COPD (BTS guidelines, 1997).

Normally, people take deep breaths or sigh regularly. These actions stretch the respiratory structures. Patients of COPD with chronic respiratory muscle weakness have reductions in lung volumes and vital capacity (VC) and they may have decreases in lung distensibility with lung volume restriction (De Troyer et al, 1980). As shown by Misuri et al (2000) failure to fully expand the lungs causes increases in lung tissue and chest wall elastance and decrease in compliance. The total mechanical work of breathing (WOB) is the sum of the work of overcoming both the elastic and frictional forces opposing inflation. In healthy adults, about two

thirds of the WOB can be attributed to elastic forces opposing ventilation. The remaining third is due to frictional resistance to gas and tissue movement. In diseased states, the WOB can dramatically increase. In patients with restrictive lung disease, work is the integration of the volume-pressure breathing curve. The increase in the WOB is a function of tissue elastance and an inverse function of pulmonary compliance (Slonim & Hamilton, 1987). Failure to take periodic deep breaths can change alveolar surface forces and increase the tendency for alveolar collapse. Gross muscle weakness alters the passive recoil of the thoracic cage, modifying the neutral position at which lung and cage recoil pressures are balanced. (Estenne et al, 1977) This results in altered inspiratory muscle length-tension relationships. The lungs and chest walls are susceptible to the effects of incomplete regular mobilization. The tendons and ligaments of the rib cage and the costovertebral and costosternal articulations stiffen, and the latter ankylose, as the intercostal and other respiratory muscles become fibrotic and contracted (Estenne et al, 1977).

Expiratory airflow is limited because of the obstruction, leading to air trapping and hyperinflation. This accentuates when the minute ventilation or respiration rate is increased, for example during exercise (O'Donnell, 2006). The hyperinflation induces increased strain on the respiratory muscles, which are forced to work in a limited range of movement with negative pressure/effort relationship, leading to

fatigue and increased dyspnea (Bellemare & Grassino, 1983). To avoid the distressing feeling of dyspnoea, the patients with COPD tend to avoid physical exertion and adapt a more sedated lifestyle than healthy elderly subjects (Pitta et al, 2005). This, in turn, leads to a vicious cycle of reduced exercise capacity inducing increased dyspnoea during exercise which leads to a further avoidance of exercise and so on.

Exercise capacity is impaired in COPD, both peak exercise capacity and functional exercise capacity. Besides lung hyperinflation and physical inactivity, ventilation-perfusion mismatch, hypoxemia, cardio-vascular problems and muscular changes contribute to the reduced exercise capacity. Functional exercise capacity is one of the key prognostic factors of morbidity and mortality in COPD (Celli et al, 2005) and correlates strongly with physical activities in daily life (Pitta et al, 2005).

Mobilization of rib cage joints appears as a specific aim for physiotherapy, as rib cage mobility seems to be reduced with obstructive lung disease. Chest wall mobilization improves mobility of chest wall, reduces respiratory rate, increases tidal volume, improves ventilation gas exchange, reduces dyspnea, decreases work of breathing and facilitate relaxation (ACCP/AACVPR Pulmonary Rehabilitation Guidelines, 1997; Kozu Ryo. et al, 1998; Achmat, 2005; Kelzuyuki. et al, 2007; Shioya. et al, 2007; Putt et al, 2008; Leelarungrayub et al, 2009).

Materials & Methods

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Study Design: Experimental study (Before and after with control), one time study
Dependent Variable: Modified Borg score values

Independent Variable: Chest Mobilization tech.

Sample design: Random sampling

Sample size: 30 Patients

Study Setting: General Hospital, Ahmedabad

Selection Criteria

Inclusion Criteria:

- Patients diagnosed as having COPD by the physician. The diagnosis was confirmed by COPD questionnaire,
- Patients with COPD with restrictive impairment (VC<80%),
- Age: >40yrs,
- Sex: male,
- Patients who are able to comprehend commands.

Exclusion Criteria:

- Patients with unstable vital parameters,
- Those who have active lung infection,
- Patients with congenital heart disease, ischemic heart disease, rheumatic heart disease,
- Patients who have recently taken bronchodilator drugs,
- Patients with continuous Oxygen therapy,
- Patients with artificial ventilation,
- Sex: Female Patients

Table 1: Difference in means of age

Group A	55.47±5.06
Group B	57.47±8.22

Outcome measure: Modified Borg Score (Mador et al, 1995):

0	None
0,5	Very, very light
1	Very light
2	Light
3	Moderate
4	A little intense
5	Intense
6	
7	Very intense
8	
9	Very, very intense
10	Maximum

Figure 1 Modified Borg Score

Patient Instructions for Borg Dyspnoea Scale: “This is a scale that asks the subject to rate the difficulty in his breathing. It starts at number 0 where his breathing is causing him no difficulty at all and progresses through to number 10 where his breathing difficulty is maximal.

Procedure: 30 patients were randomly selected according to inclusion criteria. PFT of all these patients was done. These patients were divided randomly into two groups (15 in each group), one group was experimental and other was control group. Breathlessness score was measured by Modified Borg Scale before and after

giving chest mobilization technique. Three repetitions of each maneuver was done.
Group A: Chest mobilization and Breathing exercises
Group B: Breathing exercises only

Chest Mobilization tech. of Kelzuyuki. et al, (2007) was employed that involved 1. Rib rotation 2. Chest wall rotation 3. Lateral flexion of chest wall 4. Chest wall extension 5. Pectoralis major muscle stretching



Figure 2: Rib rotation



Figure 3: Chest wall rotation



Figure 4: Lateral flexion of chest wall



Figure 5: Chest wall extension



Figure 6: Pectoralis major muscle stretching

For within group analysis, comparison of data for Modified Borg Score was done using Wilcoxon Sign Rank Test and for between groups analysis, it was done using Mann Whitney U test.

TABLE 2: Difference in means of Modified Borg Scale for Dyspnea

	Before	After	W-value	p value
Group A	2.27±0.88	1.70±0.90	55	0.0020
Group B	2.20±0.86	1.77±0.96	41	0.0371

TABLE 3: The mean of differences of outcome measures between the groups

	Modified Borg Scale
Group A	1.13±0.58
Group B	0.43±0.59

The Modified Borg Score mean of differences shows significant difference between both the groups.

(U=174, P=0.0077)

Results & Discussion

Though COPD is an obstructive type of pulmonary disease, as disease progresses, there is stiffening of chest wall which gives restrictive pattern to the diseased lung. If this little but important thing is missed in the rehabilitation of COPD patient then it can hamper the progress of rehabilitation as this restriction alters the associated physiology of lungs and chest wall and it doesn't allow other rehabilitation protocols to work in improving the condition of the patient.

Achmat (2005) had done an investigation into the immediate effect of rib mobilization and sham laser application on chest wall expansion and lung function in healthy asymptomatic males. He reported improvement in dyspnea and chest expansion values

Leelarungrayub et al. (2009) in their study found acute clinical benefits of chest wall-stretching exercise on expired tidal volume, dyspnea and chest expansion in a

patient with chronic obstructive pulmonary disease.

Putt et al. (2008), in their study on “Muscle stretching technique to increase VC and range of motion in patients with COPD” had concluded that the hold and relax technique to the pectoralis major compared with the sham technique produced significant effects on VC ($P < .01$), and right ($P < .01$) and left ($P < .05$) upper-limb range of motion. There was no significant effect on ACE, XCE, perceived dyspnea, or respiratory rate. There was no order effect for either technique.

So, in present study, stretching of chest wall muscles like intercostals and pectoralis major muscle is also emphasized by chest mobilization technique.

Shioya et al. (2007), in their study “Combination of chest wall mobilization and respiratory muscle training in comprehensive outpatient pulmonary rehabilitation improves pulmonary function in patients with COPD” had concluded that combination of chest wall mobilization by squeezing technique, RMT and RMSG in outpatient PR improve pulmonary function, exercise capacity and HRQOL in patients with stable COPD.

Above study suggest that chest mobilization can even affect the patient’s Quality of life so using of this technique can give a better life to the patient.

Conclusion: It can be concluded from the present study that Chest Wall mobilization has significant effect on Dyspnea relief in COPD patient who is having restrictive impairment of chest wall in later stage of disease.

Chest Mobilization is the definite tool for the improving condition of the patient of COPD with restrictive impairment of chest wall. So it should be included as a part of management in the patient of COPD with other exercise treatment program.

Limitations of Study: This study was done on male patients only so future study can be done with taking female patients also in the study so as to generalize the result.

The major limiting factor in present study was smaller sample size. So future study should be done on a larger sample.

This was a one time study and no further follow up was taken so could not assess the long term effect of aerobic exercise on hypertension.

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Conflict of Interest None Declared