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The Immediate Effect of Chest Mobilization Technique on Chest Expansion in Patients of COPD

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ABSTRACT

Introduction: Chronic Obstructive Pulmonary Disease (COPD) is characterized by chronic airflow obstruction. Patients with COPD often experience reductions in lung volumes and vital capacity due to chronic respiratory muscle weakness. Additionally, they may exhibit decreased lung distensibility, leading to restrictions in lung volume. The passive recoil of the thoracic cage is influenced by gross muscle weakness, altering the neutral position at which lung and cage recoil pressures are balanced. Mobilizing rib cage joints is a specific therapeutic goal, as it aims to improve reduced rib cage mobility commonly observed in obstructive lung disease.

Method: A study was conducted on COPD patients aged over 40 years, specifically including males with VC<80%. Participants with unstable vital parameters, active lung infections, or those requiring continuous oxygen therapy or mechanical ventilation were excluded. The participants were divided into two groups: Group 1 received chest mobilization and breathing exercises, while Group 2 received only breathing exercises. Chest expansion measurements were taken at the 2nd intercostal space, 4th intercostal space, and xiphoid process in both groups before and after the procedures.

Result: Result obtained from SPSS20. Mean-age of Group1 was (61.9+6.0) & of Group2 was (62.05+6.1). Comparison between groups found using independent t-tests. There was significant difference of chest-expansion at 2nd IC, 4th IC and xiphoid process between both the groups. Chest-expansion at 2nd IC(M=2.0), 4th IC(M=2.85) and xiphoid process (M=3.43) was increased in group1 than group2 (M=1.58), (M=2.01) & (M=2.49) having significant difference of $p<0.05$.

Conclusion: This study concludes that Chest Wall mobilization has significant effect on Chest-expansion in COPD patients. Hence Chest-Mobilization is definite tool for the improving condition of COPD patients, so it should be included as a part of management in COPD patients with other exercise treatment-programs.

Keywords: Chest mobilization, COPD, Chest expansion, Cloth tape measurement

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a chronic disorder characterized by persistent airflow obstruction, representing a significant cause of morbidity and mortality in India.[1] COPD is both preventable and treatable, yet its impact is compounded by notable extra-pulmonary effects that can exacerbate disease severity in affected individuals. The pulmonary component of COPD is defined by airflow limitation that is largely irreversible.[2]

Normally, individuals regularly take deep breaths or sighs, actions that help stretch the respiratory structures.[3] However, patients with COPD often experience chronic

respiratory muscle weakness, resulting in reduced lung volumes and vital capacity (VC), along with decreased lung distensibility and increased lung tissue and chest wall elasticity. [4]

In patients with restrictive lung disease, the work of breathing (WOB) is determined by integrating the volume-pressure breathing curve. The rise in WOB correlates with tissue elastance and inversely with pulmonary compliance, highlighting the critical role these factors play in influencing respiratory effort.[4]

Failure to take periodic deep breaths can lead to changes in alveolar surface forces, increasing the likelihood of alveolar collapse. Gross muscle weakness also affects the passive recoil of the thoracic cage, altering the neutral position where lung and cage recoil pressures balance. This modification results in changes to the length-tension relationships of inspiratory muscles. Additionally, inadequate regular mobilization affects the lungs and chest walls, making them susceptible to stiffness and ankylosis of the costovertebral and costosternal articulations as respiratory muscles become fibrotic and contracted.[5]

Expiratory airflow becomes restricted due to obstruction, resulting in air trapping and hyperinflation. This effect is particularly pronounced during increased minute ventilation or respiration rates, such as during exercise.[6] Hyperinflation places added strain on the respiratory muscles, forcing them to operate within a limited range of movement with a negative pressure/effort relationship, ultimately causing fatigue and exacerbating dyspnea.[7]

To mitigate the distressing sensation of dyspnea, COPD patients often limit physical exertion and adopt a more sedentary lifestyle compared to healthy elderly individuals. This behavioural adaptation sets off a detrimental cycle: reduced exercise capacity heightens dyspnea during physical activity, prompting further avoidance of exercise, perpetuating the cycle.[8]

The mobilization of rib cage joints is seen as a specific aim in physiotherapy, as rib cage mobility is observed to be reduced in obstructive lung disease. Chest wall mobilization is aimed at improving chest wall mobility, reducing respiratory rate, increasing tidal volume, improving ventilation gas exchange, reducing dyspnea, decreasing work of breathing, and facilitating relaxation.[9,10]

MATERIALS & METHODS

Selection Criteria

Inclusion Criteria: Patients diagnosed as having COPD by the physician. Patients with COPD having VC<80%, Age: >40yrs, Sex: male.

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.

Outcome measure

Chest expansion: Chest was exposed and with the help of non-stretchable inch tape the chest expansion was measured at three levels that is 2nd Intercostal Space, 4th Intercostal Space and xiphoid process. Subject was asked to exhale the air as much as possible and then take a maximal deep inspiration. The difference between the full expiration and full inspiration was noted. Three trails were given at each level and average of three readings was noted.

PROCEDURE

40 patients were randomly selected according to inclusion criteria. PFT of all these patients were done. These patients were divided randomly into two groups (20 in each group), one group was experimental and other was control group.

Group A: Chest mobilization and Breathing exercise

Group B: Breathing exercise only (Diaphragmatic breathing exercises, Pursed lip breathing)

Chest expansion values were measured before and after giving chest mobilization technique. 3 Repetitions of each maneuver was done.

Chest Mobilization techniques are

Figure 1: Rib rotation

Figure 2: Chest wall extension

Figure 3: Pectoralis major muscle stretching

Figure 4: Lateral flexion of chest wall

Figure 5: Chest wall rotation

STATISTICAL ANALYSIS

Statistical analysis was done using SPSS version 20. Data was checked for normal distribution using Shapiro-Wilk test.

As data was normally distributed, Data analysis was performed using the unpaired t-test for comparison between two groups.

$P < 0.05$ was considered as statistically significant

RESULT

The 20 participants having COPD in Group 1 had a mean age of (61.9 ± 6.0) year at baseline, whereas the 20 participants having COPD in Group 2 had a mean age of (62.05 ± 6.1) year ($P > 0.05$ for comparison).

Comparison between two groups found using independent t-tests. Table 2 shows the comparison between the group 1 and group 2 examined in this study. There was significant difference of chest-expansion at 2nd ICS, 4th ICS and xiphoid process between both the

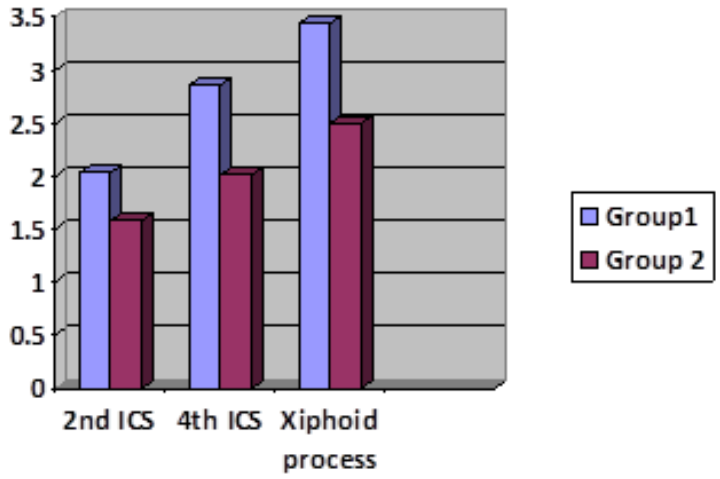
groups. Chest-expansion at 2nd ICS, 4th ICS and xiphoid process was increased in group1 than group 2 having significant difference of $p < 0.05$.

Table 1. Comparison between both groups

	Group 1 (n= 20)	**Group 2 (n= 20)**		
	Mean ± SD	**Mean ± SD**	**t value**	**p value**
2nd ICS	2.03 ± 0.36	1.58 ± 0.39	t=5.403	0.0001
4th ICS	2.85 ± 0.45	2.01 ± 0.67	t=5.406	0.0001
Xiphoid process	3.43 ± 0.75	2.49 ± 0.72	t=5.325	0.0001

P < 0.05

Graph 1. Comparison between both groups



DISCUSSION

From this study finding there is significant improvement in chest expansion after immediate chest mobilization technique in patients of COPD.

COPD is a type of obstructive pulmonary disease. As the disease progresses, the chest wall stiffens, leading to alterations in lung and chest wall physiology.[1] Hyperinflation and fatigue of the respiratory muscles contribute to reduced mobility of the spinal, rib, and sternal joints that comprise the chest wall structure.[17,18]

Kriel, Achmat (2005) had done study "An investigation into the immediate effect of rib mobilization and sham laser application on chest wall expansion and lung function in healthy asymptomatic males" and concluded that there is significant improvement in lung function.[19]

Chest mobilization facilitates increased movement of the shoulder girdle, trunk, and chest wall, effectively reducing tightness. This promotes greater flexibility of the thoracic wall, enhances respiratory muscle function, and improves ventilation. Consequently, it alleviates symptoms of shortness of breath and diminishes reliance on accessory muscles. It also decreases the atelectasis area and increase ventilation maintains expansion of lungs and prevents collapse due to which chest expansion is thought to be improved more. Thus, chest mobilization enhances chest wall expansion, thereby reducing stiffness.[20]

Putt MT, Watson M et al. (2008), in their study on "Muscle stretching tech. increases Vital capacity 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 and upper-limb range of motion. There was no significant effect on Axillary Chest Expansion,

Xiphisternum Chest Expansion, perceived dyspnea, or respiratory rate. There was no order effect for either technique.[21]

The study is subject to certain limitations. Firstly, it exclusively involved male patients, necessitating future research to include female participants for broader generalization of the results. The primary constraint of the present study was its smaller sample size, highlighting the importance of conducting future studies with larger cohorts. Moreover, this was a one-time study without subsequent follow-up, preventing assessment of the long-term effects of aerobic exercise on hypertension.

CONCLUSION

Based on the present study, it was concluded Immediate Chest Wall mobilization demonstrates a significant impact on Chest expansion values in COPD patients.

Therefore, Chest Mobilization is a crucial tool for improving the condition of COPD patients and should be integrated into their management alongside other exercise treatment programs.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

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