Original Article

The efficacy of Rib Cage Mobilization on lung function in COPD patients

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Objective: To determine the efficacy of rib cage mobilization on lung function in COPD patients
Methodology: This randomized control trial was carried out at Department of Physical Therapy and Rehabilitation, Fauji Foundation Hospital, Rawalpindi and Railway General Hospital Rawalpindi, Pakistan from sep. 2010 to sep. 2011. Sixty two patients were randomly placed into two groups, 35 in group A and 27 in group B. The inclusion criteria was at least one year history of COPD, altered Dyspnea index, and decrease FEV1/FVC ratio and the exclusion criteria was less than one year history of COPD, normal Dyspnea index and no change in FEV1/FVC ratio. All the patients were treated for three weeks and rib cage mobilization was applied in group A and deep breathing exercise in group B. The rib cage mobilization was applied in sitting and side lying position for 10th to 2nd ribs and in supine position for 1st rib. The Dyspnea index and FEV1/FVC ratio were used as assessment tools, and were calculated before and after the therapy intervention. The data was analyzed by SPSS v 20 and paired t- test was applied to calculate the probability at 95% level of significance.
Results: The rib cage mobilization increased FEV1/FVC ratio and Dyspnea index significantly (P=0.004, P=0.006) in group A, as compared to the deep breathing exercise in group B (P= 0.073, and P=0.083).
Conclusion: We conclude that rib cage mobilization had very effective role in increasing ribcage mobility and improve lung function in COPD patients. (Rawal Med J 2013;38:36-39).
Key words: COPD, rib cage mobilization, FEV1/FVC

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) causes an irreversible narrowing of the airways and dyspnea. It has low air flow on lung function tests. The risk factors for COPD are genetic, tobacco smoke, outdoor air pollutants, aging, occupational dusts and fumes, infections, asthma, male gender, socioeconomic and related factors. The mortality rate due to COPD in Pakistan is 71.1 per 100,000 people and disability rate is 584 per 100,000 people.[1] COPD is a preventable and treatable disease and physical therapy and rehabilitation can play a key role.[2,3]

The COPD is characterized by limitation in thoracic expansion with loss of mobility or movement at costochondral, costotransvese and costovertebral joints. The physical therapy management of COPD is deep breathing exercises, incentive spirometry, and endurance and strengthening exercises for the primary and secondary respiratory muscles, and rib cage mobilization.[4,5] The rib cage mobilization is applied in three positions, supine ling, sidelying and siding with arm abducted of the side to be mobilized (Table 1).[5] Deep breathing exercises were also performed by the patient in relaxed and comfortable positions including: supine and long supported sitting. The aim of this study was to determine the efficacy of rib cage mobilization on lung function in COPD patients.

METHODOLOGY

This randomized controlled trial was conducted in the out-patient physical therapy departments of Pakistan Railway General Hospital and Fauji Foundation Hospital, Rawalpindi, Pakistan from September 2010 to September 2011. The inclusion criteria was at least one year history of COPD, altered Dyspnea index, and decrease FEV1/FVC ratio and the exclusion criteria was less than one year history of COPD, normal Dyspnea index and no FEV1/FVC ratio.

Table1: Rib cage mobilization procedures.

Technique	Position	Mobilization Procedure
Technique-I for left 10th through 6th ribs, (figure-I)	**Patient position:** sidelying on right position **PT position:** standing at the head of the table **PT left hand:** radial side of index finger and thumb's web is palpating the intercostals space **PT right hand:** stabilizes the patient from proximal humerus	When the patient breathes out, fixates the lower rib, and as the patient breathes in, the operator brings the ribcage into right side bending using the proximal humerus. Apply a quick release pressure with left hand
Technique-II for right 10th through 2nd ribs, (figure-II)	**Patient position:** Sitting position at the edge of the table. **PT position:** Standing behind the patient **PT left hand:** Grabs the patient right upper extremity **PT right hand:** Thumb and index finger presses over the lower ribs	Holds back the lower rib and pulls the upper ribs cranially with inspiration. Hold for approximately 7-10 seconds, and repeat several times
Technique for 1st rib, (figure-III)	**Patient position:** Supine lying position head rotated to right or left side **PT position:** Stands at the head of the table facing the patient **PT left hand:** Web space of Left thumb and index finger is placed on the top of the patient's 1st rib r **PT right hand:** Maintaining cervical rotation	Presses the left 1st rib downward, medially, and anteriorly in the line with the patient right greater trochanter during exhalation, and maintains for 7-10 seconds

Sixty two patients who met the inclusion criteria and were randomly assigned to two groups by toss a coin method. Thirty five patients were in group A and 27 in group B. Rib cage mobilization were applied in group A for 3 weeks at 5 days per week in three different positions, in sitting (Figure 1), side lying (Figure 2) for ribs 10th to 2nd , and supine lying (Figure 3) for 1st rib. The deep breathing exercises were applied in group B for 3 weeks at 5 days per week in sitting position.

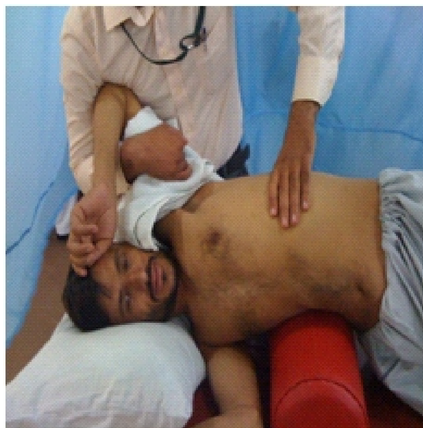

Figure 1: Mobilization of the right 10th through 2nd ribs, in side lying position.

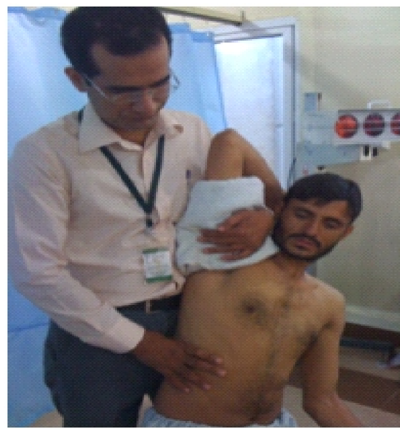

Figure 2: Mobilization of the left 10th through 6th ribs, in sitting position.

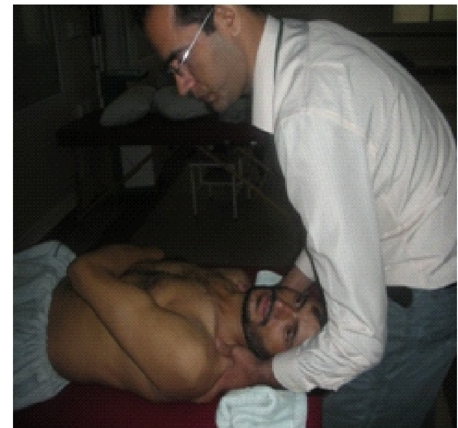

Figure 3: Mobilization of the first rib in supine lying position

The Dyspnea index and FEV1/FVC ratio were used for assessment and values were calculated before and after the physical therapy intervention program in all patients. The data was analyzed by SPSS v 20 and paired t- test was applied to calculate the probability at 95% level of significance.

RESULTS

In group A (n=35) patients, 33% showed significant improvement in FEV1/FVC ratio, 7% showed no change in FEV1/FVC ratio and 17% showed decrease in FEV1/FVC ratio ($P< 0.004$). In group B (n=27) patients, 11% showed significant improvement in FEV1/FVC ratio, 37% no change in FEV1/FVC ratio and 19% had decrease in FEV1/FVC ratio ($P<0.073$). The results of rib cage mobilization in group A were statistically significant than deep breathing exercises in group B.

DISCUSSION

Clinical practice guideline for physiotherapists treating patients with COPD have been established based on a systematic review of available evidence in 2011 which included 103 randomized control trials and suggested use of physical exercise training to improve health-related quality of life and functional exercise capacity in them.[6] Ries AL et al presented Pulmonary Rehabilitation the Evidence-Based Clinical Practice Guidelines recommended by American College of Chest Physicians (ACCP) and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) and suggested that exercises of the upper extremity and lower extremity can improve symptoms and quality of life of pulmonary rehabilitation in COPD patients.[7]

Rochester CL recommended guidelines for Exercise training in COPD and considers the exercise core component of pulmonary rehabilitation and recommended that the clinical benefits of exercise last up to 2 years following 8 to 12 weeks of training.[8] Tang et al conducted a randomized controlled trial on Chest physiotherapy for patients admitted to hospital with an acute exacerbation of COPD and concluded that the intermittent positive pressure ventilation and positive expiratory pressure may benefit patients with COPD requiring assistance with sputum clearance, while walking programmes may have wider benefits for patients with an exacerbation of COPD and were safe in these patients.[9]

Ennis et al conducted a systematic review on the effects of arm endurance and strength training on arm exercise capacity in people with COPD and suggested that this improved arm exercise capacity and arm strength training improved arm strength.[10] Our study clearly showed significant improvement with rig cage mobilization.

CONCLUSION

COPD is the significant cause for the loss of chest expansion and lung function and rib cage mobilization was very effective physical therapy intervention to increase chest expansion and lung function.

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