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Efficacy of Retraining Diaphragm by Proprioceptive Neuromuscular Facilitation versus Diaphragmatic Breathing Exercises in Reducing Dyspnoea in the Copd Patients

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Abstract:-

- ***Background and Purpose***

Chronic Obstructive Pulmonary Disease (COPD) is major cause of morbidity and mortality in globally and disease process is characterized by dyspnoea and limited exercise tolerance. Pulmonary rehabilitation improves the health-related quality of life and exercise tolerance capacity. This study was evaluated the efficacy of retraining diaphragm muscle in the COPD patients before and after performing PNF techniques and DB exercises.

- ***Method***

selected 30 COPD patients into two groups were being treated with PNF & DB and who had been referred to a pulmonary rehabilitation program; patients evaluated severity of the dyspnoea by using Borg's scale ratio 3(moderate) and 4 (somewhat severe).

- ***Results***

Upon completion of pulmonary rehabilitation, a significant improvement dyspnea score in PNF techniques shows the retraining in diaphragm muscle of COPD patients.

- ***Conclusion***

High quality studies are required to identify PNF group or DB group clinically effective.

Keywords:- *COPD, dyspnoea, Physiotherapy, PNF, DB*

I. INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is progressive disease and leading cause of morbidity and mortality world, especially in India [(1-2)]. COPD mainly caused by cigarette smoke, occupational dusts, chemicals, infections, socio-economic status, indoor and outdoor pollution[3].

The abnormal inflammatory response develops air flow limitation of the lungs which produces an obstruction of mechanical function and the gas exchanging capability of the lungs. The symptoms of COPD is cough with expectoration, wheezing, worsen shortness of breath (SOB), fatigue, chest tightness and mood disturbances. These changes contribute to a decrease in health-related quality of life (HRQL) and in daily physical activities [4–6]. Repeated exacerbations are a risk factor for increased mortality and contribute to the health care burden associated with COPD disease, especially when they result in hospitalization [7–9].

The management of patients with COPD is to minimize frequency and impact of acute exacerbations because COPD results primary impairments of the respiratory system and secondary impairments including skeletal muscle dysfunction[10].

Disease prevention is the ultimate goal of COPD once the disease is diagnosed the effective management should be carried on. The management of mild to moderate involves the avoidance of risk factors to prevent the disease progression and pharmacotherapy as needed to control the symptoms. Severe disease often requires the integration of a variety of treatment approaches like pharmacotherapy, ventilatory support and counseling[11-12].

Pulmonary rehabilitation a group of exercise and education programme to reduce symptoms, improve exercise performance and prevent exacerbations. PR has been demonstrated to improve the health-related quality of life, dyspnoea and exercise tolerance capacity[15].

The diaphragm is the main respiratory muscle in humans which accounts for 70% of the resting ventilation so the pulmonary rehabilitation mainly focused to retrain the diaphragm muscle thereby improve the physical efficiency of the COPD patients[14].

Pulmonary rehabilitation consists of chest physiotherapy technique like breathing exercise, postural drainage, spirometry, clapping, vibration and proprioceptive neuromuscular facilitation of respiration (PNF) and breathing techniques are shown to improve the ventilatory capacity and decrease dyspnoea[15-16].

Neurophysiological facilitation of respiration is also known as controlled breathing techniques the use of

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selective external proprioceptive and tactile stimuli that produce the reflexive movement response to assist respiration. These procedures have been employed in the physiotherapy chest care more than 25 years[17].

PNF techniques with autogenic stretching give respiratory muscle relaxation and improve inspiration and expiration in next inspiration –expiration cycle by reflex stretching. This way inspiration-expiration graph shows improvement with active initiation or more participation in respiration. As inspiration-expiration improves chest expansion occurs effectively due to contractions of a stretched muscle are [18- 19.]

The application of PNF techniques alter the rate and depth of breathing thereby changes of the respiratory rate, improved respiratory muscle integrity &chest stability, which improves the breathing pattern of the diaphragm and increase tidal volume·· Airflow changes more slowly in the COPD patients than the other patients, so COPD patients require more repetition of PNF stretch in each session to get result while patients with active initiation of breathing [20].

Diaphragmatic breathing (DB) increases the asynchronous and the paradoxical ribcage motion, which may account for the work of breathing. Researchers have examined DB affects overall ventilation, improves the gas exchange and decrease the respiratory rate[21].

Diaphragmatic breathing exercise reduces breathing efficiency in people with severe COPD. Diaphragmatic breathing contributes to appropriate chest wall motion and decreased mechanical efficiency in patient with dyspnoea and hypoxemia, which reduce the mechanical work of breathing and improve ventilatory efficiency[23].

II. METHODOLOGY

Studied 30 COPD patient into two sub groups

A. Proprioceptive Neuromuscular Facilitation of Respiration Techniques

15 patients received Proprioceptive Neuromuscular Facilitation of Respiration techniques to stimulate diaphragm muscle for 30 minute two times daily for 6 days in a week of 3 consecutive weeks.

Techniques of stimulating response and strengthening diaphragm muscle related to respiration by placing the thumbs and palms of the hand along the costal cartilages of the lower ribs. Pressure and stretch is applied with the thumbs pushed up under the rib cage as far possible without producing pain. The tips of the thumbs are pointed toward the xiphoid process. Repeated contractions may be performed to both sides simultaneously, or one side may emphasize with sustained pressure to the other side. Resistance applied to forced expiration in this area by resisting the downward motion of ribcage so as to prevent the diameter of the lower chest as exhales.

Rhythmic stabilization performed as stimulate diaphragm by using the thumbs .the fingers are placed contact with the lower chest walls. The patient is instructed "breathe in, and hold it". The patient sustains breath while physiotherapist applies pressure and stretch alternatively the chest wall and diaphragm .After 2 or 3 alterations, the patients instructed, "Breathe in again, again and again" while the therapist repeats with increasing and decreasing pressure to the diaphragmatic area.

B. Diaphragmatic Breathing Exercise

15 COPD patients received diaphragmatic breathing exercise, treatment 30 minute two times daily for 6 days in a week for 3 consecutive weeks. Diaphragmatic breathing occurs when there is a conscious appreciation of inspiring air to the lung bases with slight forward abdominal displacement and passive relaxed expiration. The instruction given to the patient was "breathe slowly through your nose and aim to getting air to the lower parts of your part of your lungs", remember to relax your tummy and allow the air to go under here (The investigator put his hand on the subjects epigastric /sub costal region).Then relax and let all air out through your mouth, allowing your tummy to sink gently"

➢ *Inclusive Criteria*

1. Level of dyspnoea- patients with Borg's scale rate of 3 (moderate) and 4(some what severe) on the 10 point scale
2. Haemodynamically stable patients

➢ *Exclusive Criteria*

1. Patients with pleural disorders.
2. Active lung infection like tuberculosis, typhoid, pneumonia.
3. Broncho-pulmonary fistula, Bronchial carcinoma.
4. Subjects with orthopedic deformity and trauma to chest wall.
5. History of unstable cardiovascular condition.
6. Spinal cord injuries involved the phrenic nerve.

III. RESULTS

Comparison between Group A Vs Group B- Borg scale

	GROUP	N	Mean	Std. Deviation	Z
Pre	Group A	15	3.6667	.48795	.73300
	Group B	15	3.5333	.51640	p=.464 ns
Post	Group A	15	1.0000	.56695	1.59900
	Group B	15	1.4000	.80623	p=.11 ns

Table 1

- The mean difference of Borg scale pre scale Group A is 3.6667 SD ± .48795 and Group B: 3.5333 SD ± .51640 and p value = .464 ns
- Post scale Group A: 1.0000 SD ± .56695 and Group B: 14000 SD ± .80623 with a p= .11 ns

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Comparison between Group A Vs Group B - Total score

	GROUP	N	Mean	Std. Deviation	Z
Pre	Group A	15	5.1000	.42426	.49900
	Group B	15	5.0333	.51223	p=.611 ns
Post	Group A	15	1.5733	.41484	1.68500
	Group B	15	1.8733	.43006	p=.092 ns

Table 2

- The mean difference pre total score of clinical COPD questionnaire group A is 5.1000 SD ± .42426 and group B 5.0333 SD ± .51223 and p value = .611 ns
- Post total score clinical of COPD group A: 1.5733 SD ± .41484 and group B 1.8733 SD ± .43006 and p value = .092 ns

IV. DISCUSSION

Goals of pulmonary rehabilitation is minimization of hospitalization and the reduction of mortality .The study results of Group A (PNF) (2.6667 SD±.44987) and Group B (DB) (2.1333 SD±.61140) significant difference in Borg-dyspnoea scale to the increased strength of diaphragm muscle.

Chronic Obstructive Pulmonary Disease (COPD) patients having hyperinflation of the lungs and chest wall which causes the diaphragm depressed leading to breathing inefficiency and increased demand oxygen to the muscle. These changes lead to increased ventilatory requirements and decreased ventilatory capacity of lung, patient demonstrates dyspnoea and limited exercise tolerance[38].

The PNF group appears to be an effective method to decrease dyspnoea and improve gas exchange in patient with COPD. Nita J, Burke B studied PNF technique main contributor to improve Spo2 and increase in thoraco-abdominal motion with respiratory rate declined between 15 % and 30 % immediately after treatment. PNF techniques with autogenic stretch give respiratory muscle relaxation and help to take improved inspiration and expiration in next inspiration- expiration cycle by reflex stretching. This way inspiration- expiration graph shows improvement with active initiation or participation in respiration. As inspiration- expiration improves, chest expansion occurs effectively. Chalmers G[28] reported that contractions of a stretched muscle are not only due to activation of Golgi tendons organs but instead due to presynaptic inhibition of a muscle spindle sensory signal.

The spinal cord reflex responses activation of additional respiratory muscle results to regulate by chemoreceptor for paco2, pao2, ph as well as by neural impulses from lung. The active contraction changes the muscle tissue includes actin- myosin contraction/stretching. These findings show that PNF techniques one of the functional method to retrain the diaphragm muscle in the pulmonary rehabilitation.

Evidence suggests that Diaphragmatic breathing does not change regional ventilation in people with COPD but techniques increase total ventilation due to the slower, deeper breathing patterns that may occur during DB rather than an exaggeration of abdominal motion .review of the articles on diaphragmatic breathing in stable COPD patients increased in the work of breathing due to increased paradoxical rib motion. The relaxed breath out results less air trapping and reduction of hyperinflation, which turns into reduced respiratory rate, dyspnoea and improved tidal volume and oxygen saturation in resting condition. A study by Gosselink proved deep breathing exercise which includes diaphragmatic breathing immediate decrease respiratory rate, dyspnoea and anxiety. Jones et al confirmed that DB results lower oxygen cost and respiratory rate Jones et al confirmed that diaphragmatic breathing exercise reduce the oxygen cost and reduce the respiratory rate.

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