Effect of Autogenic Drainage Versus Postural Drainage on Pulmonary Function in Chronic Obstructive Pulmonary Diseases Patients

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ABSTRACT

Aim of work: *This current study was designed to compare the short- term effects of autogenic drainage (AD) versus postural drainage (PD) on pulmonary function in chronic obstructive pulmonary disease (COPD) patients.* ***Methods:*** *A sample of 30 patients diagnosed as having moderate COPD (FEV_1 between 50 to 80 % of predicated, and $FEV_1/FVC \leq 0.7$ according to the American Thoracic Society), with symptoms of dyspnea, cough and sputum production were selected and participated in this study were selected and participated in this study. Inclusion criteria for patients were, age ranged from 20 to 40 years, stopped smoking at least three months before entering the study, no infection during the last six weeks , and all had dyspnea score of less than five on Modified Borg Dyspnea Scales. The patients were randomly divided into two equal groups; Group I treated with postural drainage, and group II treated with autogenic drainage, with total treatment time of 30 minutes, twice daily, for 20 consecutive dayps for both treatment. Pulmonary function measurements including (FEV_1, FVC, and FEV_1,/FVC) was performed before entering in study procedure after the end of therapy.* ***Results:*** *The difference concerning general characteristics (age, weight, height, and body mass index) were compared together and no statistical significance differences ($P>0.05$) were observed between groups. There were significance improvement noted in pulmonary function test (FVC, &FEV_1), for patients treated with PD, & AD with reported percentage of improvement were (0.7% and 2.97 Vs 5.06% and 6.69%), for patients treated with PD and AD respectively, as well as there were highly significance differences ($P<0.01$) in pulmonary function test (FVC, FEV_1), when compared at post treatment between patients treated with PD, and those treated with AD.* ***Conclusion:*** *Autogenic drainage was found to be superior, when compared with postural drainage at improving pulmonary function in patients with COPD, and therefore should consider as an effective method of home physiotherapy according to the patients' and the physiotherapy preferences.*

Key Words: *Chronic obstructive pulmonary diseases, percussion autogenic drainage.*

INTRODUCTION

Chronic obstructive pulmonary diseases (COPD), is a major cause of chronic morbidity and mortality throughout the world. It is now the fifth leading cause of death in the world , and further increase in the prevalence and mortality of the diseases is predicated in the coming decades[1].

COPD is a chronic progressive disorder characterized by reduce maximum expiratory flow and slow forced emptying of the lung {reduced forced expiratory volume in one second to forced vital capacity (FEV_1/FVC), and forced expiratory volume in one second (FEV_1)}, which is not fully reversible and does not change markedly over several months[2].

Pathological changes in COPD is characterized by chronic inflammation throughout the central and peripheral airways, lung parenchyma, and pulmonary vasculature. These changes lead to; mucus hypersecretion, ciliary dysfunction, airflow limitation,

pulmonary hyperinflation, gas exchange abnormalities, pulmonary hypertension, and cor pulmonale. Mucus hypersecretion and ciliary dysfunction lead to chronic bronchitis, with cough and sputum production[1].

Chest physical therapy including several techniques is widely used intervention in patients with airway diseases aimed to improve mucus clearance, to decrease the risk of pulmonary infection, slow the decline in pulmonary function and improve quality of life[3]. One of these techniques involves postural drainage (PD), that commonly used for patients with a variety of pulmonary disorders, it is recommended in COPD when patients produce more than 30 ml/day of sputum. This therapy requires assistance from another person and has been associated with a decrease in oxygen saturation, suggesting the need for improved secretion removal techniques[4].

Published studies provide sparse information about efficacy and effectiveness of PD, as some indicated that PD may either benefit while other concluded that PD might worsen obstructive airway disease[4,5].

Autogenic drainage (AD) is a system of breathing exercises developed in 1967 by Jean Chevallier in Belhuim, to sequentially attain the highest possible expiratory flows to move secretion from peripheral to central airways, without forced expiration and associated airway closure. The AD consists of three phases; (1) the "unsticking" phase, which loosens secretion in the peripheral airways, (2) the "Collecting" phase, which moves secretion to larger, more central airways, and (3) the "evacuating" phase, which results in the removal of the secretion. It is self drainage method that is performed independently by the patients in sitting position[6].

Published studies about AD are limited, and found that AD and high pressure positive expiratory pressure; both significantly improved pulmonary function test in cystic fibrosis patients[7]. On the other hand it was found that no differences in clinical status or pulmonary function results when comparing AD versus PD in two years crossover study for patients with COPD[8]. Therefore this current study was designed to compare the short- term effects of autogenic drainage versus postural drainage on pulmonary function in COPD patients.

MATERIALS AND METHODS

Patients

A sample of 30 patients diagnosed as having moderate COPD (FEV_1 between 50 to 80 % of predicated, and $FEV_1/FVC \leq 0.7$ according to the American Thoracic Society), with symptoms of dyspnea, cough and sputum production were selected and participated in this study were selected and participated in this study. Inclusion criteria for patients were , age ranged from 20 to 40 years, stopped smoking at least three months before entering the study, no infection during the last six weeks, and all had dyspnea score of less than five on Modified Borg Dyspnea Scales. The patients were excluded if they had cardiac, orthopedic, neurological or psychological diseases that might have interfered with therapeutic procedures. The patients were randomly divided into two equal groups; Group I treated with postural drainage, and group II treated with autogenic drainage .An informed consent was obtained from each patient before entering in study procedures. Base line demographic characteristics for patients included in the studies are presented in table (1).

Procedures

Pulmonary function measurements:

Pulmonary function measurements including (FEV_1, FVC, and FEV_1,/FVC) was

performed using (Schillar AG Spirovit SP-10, made in Swiss). The equipment was calibrated prior to measurements. The patients were in sitting position and nose clip was used to prevent air from passing through the nose, and then put a mouth piece into mouth firmly and breath few times before test procedure to be familiarized with the device, and then patients were asked to breath in deeply then expired forceful into the mouth piece as much they could. The mean values of three successful trail was obtained, and related to age, height, and body mass index (BMI), according to the values reported by American Thoracic Society.

Techniques of secretion removal:

Treatment with postural drainage (Group I); patients received PD and manual chest percussion that consisted of placing the patients in different positions, while therapist manually clapped and vibrated various areas of the chest wall to increase secretion removal from a particular segment of the lung. Following clapping in each position, the patient was instructed to huff and cough to expectorate the mobilized mucus[4].

Treatment with autogenic drainage (Group II); the patient should seated upright in a chair with a back for support, and then the patients were instructed in the technique of AD through the following steps.

In all phases, inhalation should be done slowly, through the nose using diaphragm or lower chest. A two to three second breath hold should follow, allowing collateral ventilation to get air behind the secretion.

Exhalation should occur through the mouth with the glottis open, causing the secretion to be heard, once these accomplished, the patients breaths at three different lung volumes (phases), utilizing a controlled expiratory flow rate to avoid airway compression.

The unsticking Phase; this phase mobilized mucus from the periphery of the lung by lowering the mid –tidal volume below the functional residual capacity level. For this purpose; the patients attempts to exhale as far into expiratory reserve volume as possible, contracting the abdominal muscles to achieve this. This low lung volume breathing continues until the mucus is loosened and starts to move into the larger airway.

The Collecting Phase; this phase collects the mucus in the middle airways by increasing the lung volume over the unsticking phase. Tidal volume breathing is then changed gradually from expiratory reserve volume toward the inspiratory reserve volume range, so that the lungs are expanded more with each inspiration .For this purpose; the patient increases both inspiration and expiration to move greater volume of air, this continues until the sound of the mucus decreases, signaling its movement into the central airways to be evacuated.

The Evacuating Phase; in this phase, the patient increases inspiration into inspiratory reserve volume range, and this middle to high lung volume breathing continues until secretion collected in trachea, and ready to expectorated. The collected mucus can be evacuated by stronger expiration (i.e. cough). The total time spent for either treatment was 30 minutes, twice daily, for 20 consecutive days[9].

Data Analysis

The results are expressed as mean and standard deviation. Data were analyzed through paired t test within treatment groups, and unpaired t test between treatment groups, with reported percentage of improvement. Differences were tested to be significance at ($\alpha \leq 0.05$) level.

RESULTS

As shown in table (1), the difference concerning general characteristics (age, weight, height, and body mass index) between patients of both groups were compared together and there were no statistical significance differences (P>0.05) were observed between them.

Table (I): Demographic characteristics for patients included in the study.

Variables	Postural Drainage (Group I)	Autogenic Drainage (Group II)	P-value
	X±SD	X±SD	
Age (years)	30.66±6.48	29.8±6.38	0.71'
Weight (Kg)	68.66±5.15	68.93±5.49	0.89'
Height (cm)	171.66±6.94	170.6±6.56	0.66'
BMI (Kg/cm^2)	23.35±2.06	23.6±1.1	0.61'

X: Mean SD: Standard Deviation BMI=Body mass index ' Non-significance (P<0.05)

Results of pulmonary function:

There were significance differences noted in pulmonary function test (FVC, & FEV_1), results for patients treated with PD. As the mean values of FVC at pre and post treatment were (2.85±1.89 Vs 2.87±0.79L, P<0.05), while for FEV_1 was (2.35±1.08 Vs 2.42±0.65L, P<0.05), respectively. The reported percentage of improvement FVC, and FEV_1 were (0.7% and 2.97%), respectively as in table (2), fig. (1).

There were highly significance differences observed in pulmonary function test (FVC, &FEV_1), results for patients treated with AD. As the mean values of FVC at pre and post treatment were (2.96±1.03 Vs 3.11±0.1.2 L, P<0.001), while for FEV_1 was (2.44±0.61 Vs 2.61±1.07L, P<0.001), respectively. The reported percentage of improvement for FVC, and FEV_1 were (5.06% and 6.69%), respectively as in table (3), fig. (2).

There were no significance differences (P>0.05) in pulmonary function test (FVC, & FEV_1), results at pre treatment between patients treated with PD and those treated with AD, as in table (4) and fig (3). While there were highly significance differences (P<0.01) in pulmonary function test (FVC, FEV_1), results at post treatment between patients treated with PD, and those treated with AD, with more improvement toward autogenic drainage group as in table (5) and fig. (4).

Table (2): Statistical analysis of mean values of FVC and FEV1 for Postural drainage (group I).

Variables	Postural Drainage (Group I)		% of changes	P-value
	Pre	Post		
	X±SD	X±SD		
FVC (L)	2.85±1.89	2.87±0.79	0.7%	0.05*
FEV_1 (L)	2.35±1.08	2.42±0.65	2.97%	0.04*

X: mean SD: Standard deviation FVC: Forced vital capacity
FEV_1: Forced expiratory volume in one second L: liters * Significance (P<0.05)

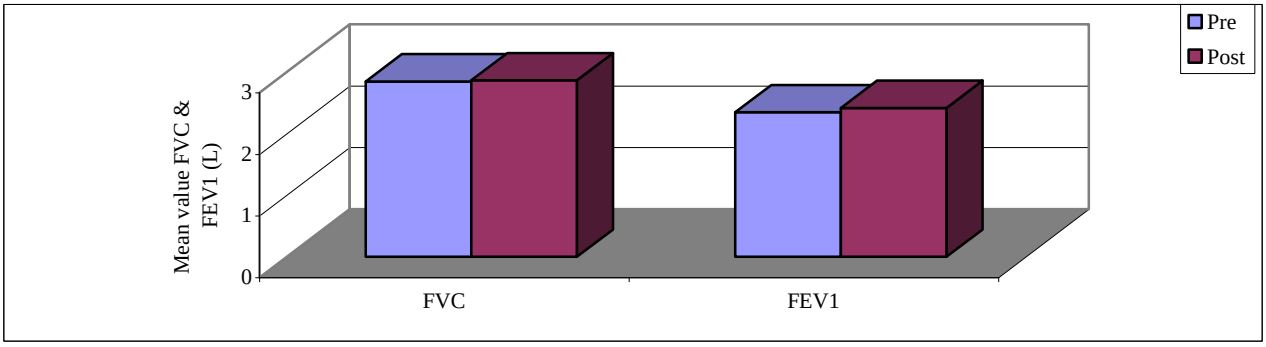

Fig. (1): Mean values of FVC and FEV1 at pre and post treatment for Postural drainage (group I).

Table (3): Statistical analysis of mean values of FVC and FEV1 for Autogenic drainage(group II).

Variables	Autogenic Drainage (Group II)		% of changes	P-value
	Pre	Post		
	X±SD	X±SD		
FVC (l)	2.96±1.03	3.11±1.2	5.06%	<0.01**
FEV_1 (l)	2.44±0.61	2.61±1.07	6.69%	<0.01**

X: mean SD: Standard deviation FVC: Forced vital capacity
FEV_1: Forced expiratory volume in one second L: liters ** Highly Significance (P<0.01)

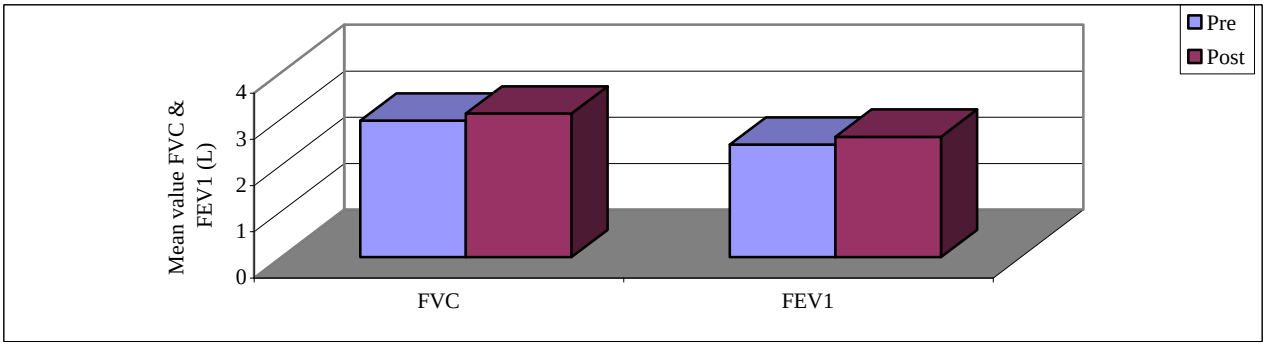

Fig. (2): Mean values of FVC and FEV1 at pre and post treatment for Autogenic drainage (group II).

Table (4): Statistical analysis of mean values of FVC at pre and post treatment for Postural drainage (group I) and Autogenic drainage(group II).

Variables	FVC (L)		P-value
	Postural Drainage Group I	Autogenic Drainage Group II	
	X±SD	X±SD	
Pre	2.85±1.89	2.87±0.79	0.66'
Post	2.96±1.03	3.11±1.2	<0.05*

X: mean SD: Standard deviation FVC: Forced vital capacity
L: liters ' Non significance(P>0.05) * Significance (P<0.05)

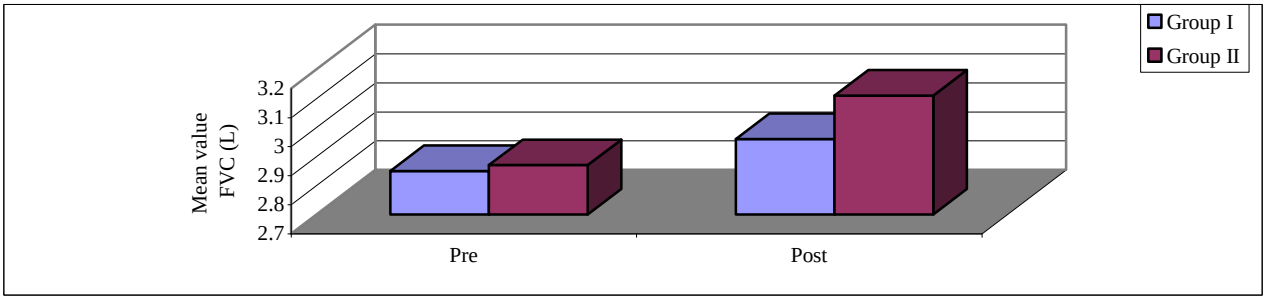

Fig. (3): Mean values of FVC at pre and post treatment for Postural drainage (group I) and Autogenic drainage(group II).

Table (5): Statistical analysis of mean values of FEV1 at pre and post treatment for group I (Postural drainage) and group II (Autogenic drainage).

Variables	FEV_1 (L)		P-value
	Postural Drainage (Group I)	Autogenic Drainage (Group II)	
	X±SD	X±SD	
Pre	2.35±1.08	2.42±0.65	0.56'
Post	2.44±0.61	2.61±1.07	<0.05*

X: mean SD: Standard deviation FVC: Forced vital capacity L: liters
' Non significance (P>0.05) * Significance (P<0.05)

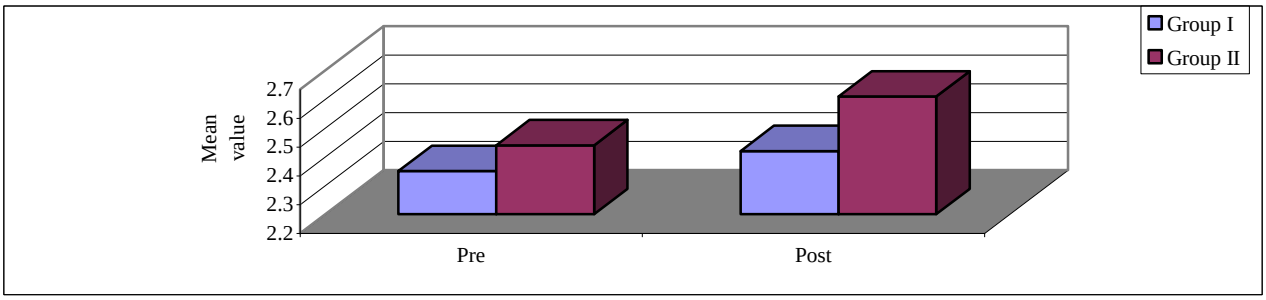

Fig. (4): Mean values of FEV1at pre and post treatment for Postural drainage (group I) and Autogenic drainage (group II).

DISCUSSION

In this study, both treatment; PD and AD results in improvement in pulmonary function (FVC & FEV_1) in patients with COPD with associated greater and significance improvement for those treated with AD. This suggested that AD may be useful and for some patient with COPD, superior to PD, as secretion clearance technique and pulmonary function improvement. Postural drainage and associated percussion are presumed to augment the clearance of sputum from the airways by brining the force of gravity and vibration to the aid of the normal airway clearance mechanisms. If the postural drainage & percussion succeeds in doing this, then acutely measurable improvement should be seen in several related factors. These factors would include increased sputum production, re even distribution of ventilation, increased expiratory flow rate, reduced airway resistance, increased vital capacity and improved oxygenation. The expected long – term results of this therapy would be more rapid improvement in clinical signs of

diseases, X-ray abnormalities, and pulmonary function and gas exchange[10].

The results of PD in this study are comparable with other previous studies. It was reported that PD significantly improve lung function (expiratory flow rate) a both low and high lung volumes[11], also an increased in pulmonary function (Peak expiratory flow) at 30 minutes after PD, therapy was detected[12]. More over It was reported that PD combined with forced expiration technique significantly increased FVC and FEV_1 immediately after, and after five minutes and these results decreased significantly when measured at 15, 30, and 45 minutes of therapy[13]. However; the results of PD on pulmonary function in this study are contradicted to that found in other studies of patients with COPD, Both Mazzocco et al.,[14] and May and Munt[15] studies patients with COPD, with scant secretion and found no improvement in FVC or FEV1 after treatment with chest physical therapy (PD& Percussion). Also Campbell et al.,[16] and Newton and Stephenson[17]. evaluated the effect of chest physical therapy (PD & Percussion), on pulmonary function in patients with an exacerbation of chronic bronchitis. In former study, the use of PD and percussion, was associated with a fall in the FEV_1, while latter study could show no improvement in pulmonary function after chest physical therapy. A previous study has suggested undesirable side effects of chest therapy on pulmonary function and gas exchanges in COPD patients and acutely ill patients[18]. Other studies have evaluated the effect of PD in patients with cystic fibrosis and acute exacerbation of chronic bronchitis and it failed to find a significance improvement in pulmonary function (FVC and FEV_1) with either PD, or AD during treatment and after one hour in patients with cystic fibrosis[19]. Also it was found that PD is safe and effective in removing secretion but no significance improvement observed in pulmonary function after end of treatment or when compared with a device that provide oscillating positive expiratory pressure and slow expiration with glottis open in lateral posture[4].

The results of AD in this study are comparable with other previous studies, which concluded that AD enhance mucus clearing in patients with cystic fibrosis more when compared with active cycle of breathing, with associated significant improvement in pulmonary function (FVC< & FEV_1) of either treatment, however there ere no significant difference when tow group compared together[20].

Also the effect of long term treatment of AD and active cycle of breathing techniques were evaluate in patients with COPD, after 20 days of therapy, and results were in agreement with finding of this study as there were significance improvement in FVC and FEV1 for patients who were treated with either treatment AD, and active cycle of breathing[21].

In conclusion, the results of this study suggest that, both treatment are effective in improving pulmonary function without causing any undesirable side effect in patients with COPD. Because autogenic drainage allows patients to do their by themselves, it might represent a valid alternative to postural drainage, and should be considered very attractive first choices of chest physiotherapy in treatment of COPD. Further studies will be needed to verify the long –term effect of these treatment, particularly with respect to oxygen saturation, quality of life, and lung compliance.

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