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Research Article

A STUDY TO COMPARE THE EFFECT OF AUTOGENIC DRAINAGE AND FLUTTER DEVICE ON PEFR, SPO_2 AND FEV_1 IN MODERATE TO SEVERE COPD PATIENTS

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A B S T R A C T

Chronic obstructive pulmonary disease is a common, preventable, treatable disease that is characterized by persistent respiratory symptoms and airflow limitations that is due to airways and/or alveolar abnormalities usually caused by significant exposure to noxious particles /gases. Hypersecretion in COPD leads to obstruction in airways. Bronchial hygiene techniques like Postural drainage, ACBT, manual hyperinflation, flutter, acapella and autogenic drainage are used to remove secretions. Flutter and autogenic drainage can be self administered by the patients and are easy to learn. Aim: To compare the effect of Autogenic Drainage and Flutter device on PEFR, SpO_2 and FEV_1 in moderate to severe COPD patients. Method: Forty-four patients having moderate to severe COPD participated of which 22 were given autogenic drainage and 22 were given flutter and its effect was seen on PEFR, SpO_2 and FEV_1. Treatment was given once daily for 5 days. Result: Both the techniques were effective in improving PEFR, SpO_2 and FEV_1 but flutter was more effective in improving FEV_1. Conclusion: The present study concluded that both autogenic drainage and flutter are equally effective in improving PEFR, SpO_2 and FEV_1 but flutter is more effective in improving FEV_1 and easier for the patient to learn and less time consuming than autogenic drainage.

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INTRODUCTION

COPD is a disease that is characterized by persistent respiratory symptoms and airflow limitations that is due to airways and/or alveolar abnormalities usually caused by significant exposure to noxious particles /gases. The chronic airflow limitation that is characteristic of COPD is caused by mixture of small airways disease (eg.Obstructive bronchiolitis) and parenchymal destruction (emphysema) .The changes does not occur together but involve at different rates over time.(Singh D *et al*., 2019)

Globally COPD was the 4th (5.1%) leading cause of death in 2004 and is projected to occupy the 3rd (8.6%) position in 2030.(Rabe KF *et al*., 2007) India and china constitutes 33% of total human population and account for 66% of global COPD mortality.(Sundeep Salvi and Anurag Agrawal. 2012) (Rajkumar P *et al*. 2017)

The two major component of COPD are: 1. Chronic Bronchitis and 2. Emphysema

1. ***Chronic Bronchitis:*** It is a condition in which chronic production of cough is present for at least 3 months per year for at least 2 or more consecutive years.
2. ***Emphysema:*** It is a condition characterized by abnormal, permanent enlargement of airspaces beyond the terminal bronchiole, accompanied by destruction of walls of airspaces without fibrosis.

Signs and symptoms of COPD are chronic cough with phlegm, dyspnea, reduced airflow, lung volumes normal or increased, reduced gas exchange and reduced diffusion capacity. (Robert M. Kacmarek *et al*. 10th edition)

Spirometry is the most common pulmonary function test that measures the maximum volume of air that an individual can inspire and expire with maximum effort.[8] It also helps to determine the severity of COPD which includes four stages - Stage I: Mild; Stage II: Moderate; Stage III: Severe; Stage IV: Very Severe. (Singh D *et al*., 2019)

FEV1 (Forced Expiratory Volume in One Second) is the maximum amount of air exhaled in the first second of a forced expiration from a position of full inspiration. (Graham BL *et al*. 2019)

A pooled analysis was done by Paul W Jones et.al in 2011 on "Correlating changes in the lung function with patient

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outcomes in chronic obstructive pulmonary disease" which concluded that large improvement in FEV_1 are associated with larger patient reported benefits across a range of clinical outcomes. (Jones PW *et al*. 2011)

Peak Expiratory Flow Rate (PEFR) is the highest flow of air achieved from a maximum forced expiratory manoeuvre started without hesitation from a position of maximal lung inflation. Peak flow meter is used to measure PEFR. (Wanger J *et al*. 2005)

Kassim Mhamed Sultan *et al*. conducted a study in 2011 on "Relationship between FEV_1 and PEF in patients with obstructive airway diseases" which concluded that PEF can reliably exclude airway obstruction when normal values is present. (Muhammed.W.AL.Obaidy *et al*. 2011)

SpO_2 is the oxyhemoglobin saturation level in arterial blood. It is measured using pulse Oximeter. Normal value of SpO_2 is 95%-100%. (Pierson DJ *et al*. 2006)

Schermer Tjard *et al*. in 2009 conducted a study on "Pulse oximetry in family practice: indications and clinical observations in patients with COPD" which concluded that family practice report a wide range of indication for pulse oximetry in acute as well as non-acute situations. (Schermer T *et al*. 2009)

Pulmonary Rehabilitation includes Pharmacological treatment like Anticholinergic, Beta2 agonist and supplemental oxygen, smoking cessation. Physiotherapy treatments includes Bronchial hygiene techniques like ACBT, manual hyperinflation, Positive expiratory pressure(PEP) by flutter, Acapella, autogenic drainage, pursed lip breathing, comprehensive directed breathing, flexibility exercise, endurance exercise, strength training. (Vestbo J *et al*. 2013)
A meta-analysis done by Mcllwaine M et.al in 2019 demonstrated that there was a significant reduction in pulmonary exacerbations in people using PEP compared to those using high frequency chest wall oscillation (HFCWO) (McIlwaine M *et al*. 2019)

Flutter, a hand held device is a form of PEP in combination with high frequency oscillation It is a small, pipe shaped portable device with a single opening at the mouthpiece and a series of small outlet holes at the top of the bowl. Bowl contains high density stainless steel ball enclosed in a small cone. During expiration the movement of the ball along the surface of the cone creates PEP and an oscillatory vibration of the air within the airways.(Donna Frownfelter and Elizabenth Dean, 5th edition) (Jennifer A. Pryor, S. Ammani Prased, 3rd edition)

A study was done by Richa *et al*. in 2018 on "Comparison of the effect of flutter and ACBT technique in acute exacerbation of COPD patients" which concluded that both flutter device and ACBT is effective in improving SpO_2 and PEFR in COPD patients. (Richa *et al*. 2010)

Autogenic Drainage is an 'antidyspnea' technique introduced by Chevaillier in Belgium in 1967. It consists of three phases: a. Unsticking phase in which patient breaths at low lung volume b. Collecting phase in which patient breaths at tidal volume c. Evacuation phase in which patient breaths at high lung volume. (Chevaillier J. 2016)

A study done by Ganeshwara Rao Melam *et al*. in 2012 on "Comparison of Autogenic Drainage & Active Cycle Breathing Techniques on FEV, FVC & PEFR in Chronic Obstructive Pulmonary Disease" and concluded that both ACBT and AD is equally effective in improving FEV_1 , FVC and PEFR in COPD patients. (Ganeswara Rao Melam *et al*. 2012)

Need of the Study

There is lack of evidence on comparison of flutter and autogenic drainage for airway clearance in patients with COPD.

Thus the purpose of this study is to compare the effect of Autogenic Drainage and Flutter on PEFR, Spo_2 and FEV_1 in COPD patients.

Aim of the Study

To compare the effect of Autogenic Drainage and Flutter device on PEFR, SpO_2 and FEV_1 in moderate to severe COPD patient

Objectives of the Study

1. To study the effect of Autogenic Drainage on PEFR, SpO_2 and FEV_1 in moderate to severe COPD patients
2. To study the effect of Flutter device on PEFR, SpO_2 and FEV_1 in moderate to severe COPD patients
3. To Compare the effect of Autogenic Drainage and Flutter device on PEFR, SpO_2 and FEV_1 in moderate to severe COPD patients

Null Hypothesis: There will be no significant difference between the effect of Autogenic Drainage and Flutter device on PEFR, SpO_2 and FEV_1 in moderate to severe COPD patients.

Alternate Hypothesis: There will be a significant difference between Autogenic Drainage and Flutter device on PEFR, SpO_2 and FEV_1 in moderate to severe COPD patients.

MATERIALS AND METHODOLOGY

Inclusion Criteria

1. COPD patients (Moderate and severe COPD)
2. Age group 40-60 years
3. Both males and females

Exclusion Criteria

1. Acute exacerbation of COPD
2. Patients with any other co-existing respiratory conditions.
3. Patients with any neuromuscular disorders
4. Patients with any cardiovascular disorders
5. Patients with Recent thoracic/abdominal surgery
6. Patients who are hemodynamically unstable
7. Patients on oxygen therapy
8. Uncooperative patients
9. Patients who are not able to perform the maneuver.

Material Used

1. Spirometer (Medicaid systems an ISO 13485 : 2003 Company)
2. Cotton
3. Spirit
4. Mouth piece
5. Pen
6. Paper

7. Nose clip
8. Flutter
9. Plinth
10. Peak flow meter
11. Pulse oximeter
12. Consent form

Outcome Measures

FEV_1 (Forced expiratory volume in 1 sec.): It is the maximal volume of air exhaled in the first second of a forced expiration from a position of full inspiration, expressed in liters.(Richa *et al*. 2010)For FVC and FEV_1 subjects were asked to take the deepest breath as much as possible than place the mouthpiece in mouth with lips sealing it and immediately exhale hard and fast for as long as possible, at least for 6 seconds followed by a rapid inspiration from the mouthpiece.(Jones PW *et al*. 2011)

Fig 1 Patient Performing PFT

1. SpO_2: SpO_2 is the oxyhemoglobin saturation level in arterial blood. Normal value of SpO_2 is 96%-100%; low value: $\leq$ 95%; decrease: $\geq$ 2% from baseline to < 96%. It was measured using pulse oximeter.(Graham BL *et al*. 2019)
2. PEFR: Peak expiratory flow rate is the highest flow of air achieved from a maximum forced expiratory manoeuvre started without hesitation from a position of maximal lung inflation.(Muhammed.W.AL.Obaidy *et al*. 2011) Patient is asked to take deep breath through nose and then exhale forcefully and as fast as possible after maintaining tight seal between lip and mouth piece of the instrument. Reading should be taken keeping the instrument in horizontal position.(Mrindha MA *et al*. 2011)

Fig 2 Patient Performing PEFR

Procedure

Subjects who fulfill inclusion criteria were selected from the population. Subjects were explained about the purpose of the study. Written consent form was obtained from the subject before starting the treatment. The demographic data (age, gender, weight, height, BMI, occupation, etc.) was collected from all subjects. Subjects were divided into 2 groups as per purposive sampling distribution. Group A was given Flutter and Group B was given Autogenic Drainage. Outcome measure was taken before and after the program schedule.

Both the groups were given treatment for 5 days one session daily. Outcome measures were taken on the 1st day before treatment and on the 5th day after treatment.

Group A: Flutter

- Seat in a comfortable position leaning forward with elbows supported on a table and neck slightly extended in order to open up the airway.
- The flutter device is held horizontally and tilted slightly upwards to get maximal oscillatory effect and then it is placed in the mouth
- Inspiration done through the nose with a breath hold of 3-5 seconds. Breath out through the flutter device. (Richa *et al*. 2010) (Chevaillier J. Autogenic Drainage 2016)

Fig 3 Patient Performing Flutter

Group B: Autogenic Drainage

Sit and relax with back supported and neck slightly extended. Clear the upper airways (nose or throat) by huffing or blowing nose. The procedure is done in 3 phases:

- Unsticking phase : Breathe at low lung volume
- Collecting phase : Breathe at mid lung volume
- Evacuation phase: Breathe at high lung volume.

Expiration is till patient's expiratory reserve volume in all 3 phases. (Richa *et al*. 2010) (Chevaillier J. Autogenic Drainage 2016)

Fig 4 Patient Performing Autogenic Drainage

RESULT

Table 1 Intragroup Comparison of Group A (Flutter)

Parameters	Pre- treatment		Post- treatment		T Value	P Value	Result
	MEAN	SD	MEAN	SD			
FEV_1(L)	0.839	0.143	0.911	0.150	-4.70	0.00	S
SpO_2(%)	98.45	0.45	98.86	0.128	-3.28	0.03	
PEFR(L/min)	176.36	35.12	212.72	42.22	-10.93	0.00	

The result showed significant difference in FEV_1 (t value = -4.70; p=0.00), SpO_2 (t value = -3.28; p=0.03) and PEFR (t value = -10.93; p=0.00)

Table 2 Intragroup Comparison of Group B (Autogenic Drainage)

Parameters	Pre- treatment		Post- treatment		T Value	P Value	Result
	Mean	SD	Mean	SD			
FEV_1(L)	0.90	0.140	0.93	0.147	-5.181	0.00	S
SpO_2(%)	98.18	0.79	98.54	0.59	-3.464	0.02	
PEFR(L/min)	171.81	36.72	205.90	39.60	-13.533	0.00	

Interpretation: The result showed significant difference in FEV_1 (t value = -5.181; p=0.00), SpO_2 (t value = -3.464; p=0.02) and PEFR (t value = -13.533; p=0.00)

Table 3 Between Group Comparison

Parameters	Flutter		Autogenic Drainage		T Value	P Value	Result
	MEAN	SD	MEAN	SD			
FEV_1(L)	0.072	0.072	0.032	0.029	2.37	0.022	S
SpO_2(%)	0.136	0.351	0.363	0.492	- 1.76	0.085	NS
PEFR(L/min)	36.36	15.59	34.09	11.815	0.54	0.589	NS

Interpretation: The result showed significant difference in FEV_1 (t value=2.73; p=0.02) which is more in Flutter group than Autogenic Drainage but there is no significant difference in SpO_2 (t value=1.76; p=0.085) and PEFR (t value=0.54; p=0.58) between both groups.

DISCUSSION

The result of the present study supports the null hypothesis for PEFR (t value=0.54; p=0.58) and SpO_2 (t value=-1.76; p=0.085) which states that there is no significant difference between both the groups and result of FEV_1 changes (t value=2.73; p=0.02) supports alternate hypothesis which states that there is significant difference between both groups and it is more improved in flutter than autogenic drainage. There is statistically significant difference in FEV_1, SpO_2 and PEFR within group.

The first objective of the study was to study the effect of Autogenic Drainage on PEFR, SpO_2 and FEV_1, in moderate to severe COPD patients.

In Autogenic drainage the patient sequentially attains the highest possible expiratory flows to move secretions from periphery to central airways without forceful expiration and associated airway closure. It incorporates staged breathing at different lung volumes. Patient is asked to breathe at low lung volumes till the secretions are felt or heard gathering in the airways. Then breaths at larger volumes are taken and patient is instructed to push secretions up the airways and at last huff or cough is done to remove secretions. (Fink JB. *et al*. 2007)
Autogenic Drainage is effective in improving FEV_1. This result was supported by a study done by A.Ilayaraja *et al*. in 2008 on "The effect of autogenic drainage versus postural drainage on pulmonary function test in COPD patients" and concluded that both AD and PD are equally effective in improving pulmonary function but because AD can b performed by the patient himself it should be considered first choice of treatment in COPD patients. (Ilayaraja A *et al*. 2008)

AD also improves PEFR and SpO_2 in COPD patients. In 2000 Savci *et al*. conducted a study on "A comparison of Autogenic drainage and active cycle of breathing technique in patients with COPD" and concluded that AD and ACBT are equally effective in clearing secretions and improving lung function. PEFR and oxygen saturation increased significantly higher in AD than that in ACBT. (Savci S *et al*. 2000)

The second objective of the study was to study the effect of Flutter on PEFR, SpO_2 and FEV_1 in moderate to severe COPD patients. Flutter device causes pressure related bronchial expansion involving a separation of the bronchial mucus from the bronchial wall; easing of expectoration due to intermittent respiratory flow acceleration (stop and go breathing); expiration against resistance leads to contraction of the abdominal musculature which tenses and arches the diaphragm, improves the length to tension ratio, reduces dyspnea and eases expectoration; reduces viscoelasticity of the mucus. (Cegla UH *et al*. 2000)

The result of the present study is supported by the study of Kunika K Jaiswal *et al*. in 2019 on "The effectiveness of acapella, flutter and Active cycle of breathing technique on lung function in COPD patients: A comparative study" concluded that there was significant change in the lung function (FEV_1, FVC, FEV_1/FVC) within the three groups but no significant change seen in between group analysis thus all the 3 techniques are equally effective in improving lung function. (Jaiswal KK *et al*. 2019)

There is significant improvement in PEFR after giving Flutter. This result is supported by a study done by Nesreen G. EL-Nahas *et al*. in 2011 on "Oscillating Positive Expiratory Pressure Improves Peak Expiratory Flow and Exercise Capacity in Patients with Chronic Obstructive Pulmonary Disease" and concluded that oscillating positive expiratory pressure in the form of Flutter device in moderate COPD men patients with chronic sputum production improved exercise capacity and peak expiratory flow. (Nesreen G *et al*. 2011)
Richa *et al*. (2010) conducted a study "A comparison of flutter device and ACBT in acute exacerbation of COPD patients"

and concluded that flutter is as effective as ACBT in improving pulmonary function and oxygen saturation without causing any untoward effects on respiratory rate in patients with acute exacerbation of COPD. (Richa *et al*. 2010)

The third objective was to compare the effect of Autogenic Drainage and Flutter device on PEFR, SpO_2 and FEV_1. The result of present study showed that both Autogenic Drainage and Flutter device are equally effective in COPD patients. Flutter device was more effective in improving FEV_1 than Autogenic drainage.

CONCLUSION

In conclusion this data provide further evidence on the effectiveness of Autogenic Drainage and Flutter in COPD patients. Both Autogenic Drainage and Flutter are equally effective in improving PEFR, SpO_2 and FEV_1 but Flutter is more effective in improving FEV_1 and is easy for the patient to learn and perform and less time consuming than Autogenic Drainage.

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