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Research

To study the effect of Different Positions on FVC and FEV1 measurements in Obstructive Pulmonary Disease Patients.

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Abstract

Obstructive diseases include conditions in which there is a resistance to airflow either through reversible factors such as bronchospasm or inflammation, or through irreversible factors such as airway fibrosis or loss of elastic recoil owing to damage to the airways and the alveoli. Types include: COPD, Asthma and Cystic fibrosis. COPD is a common disease worldwide. Worldwide prevalence of COPD ranges from 4–6%. Spirometry can be helpful in determining the effects of position on ventilator functions. It is the best method for detecting borderline to mild airway obstruction, which occurs early without the appearance of any symptoms or signs. FEV1 is the most important spirometry measure for the assessment of airflow obstruction. Many researchers have reported significant changes in pulmonary function with positioning. Reductions of 12% for forced vital capacity and 15% for force expiratory volume in one second have been observed in normal individuals between the different body positions of sitting and slumped half lying. The aim of the study was to determine the Effect of different positions on FVC and FEV1 measurements in obstructive pulmonary disease patients. The objective of this study was to investigate changes in pulmonary function values of obstructive pulmonary disease patients with change in position.30 samples were selected according to convenient sampling. Outcome measures were FEV1 and FVC which were calculated in different positions and the result was obtained for comparing the values of FVC and FEV1 in all the test positions. On application of ANOVA test the following values were obtained. For FVC the f value obtained is 4.187 and p value obtained is 0.003 which is statically significant. For FEV1 the f value obtained is 6.343 and p value obtained is 0.006 which is statically significant. There is an effect of various body positions on FVC and FEV1 in patients with obstructive pulmonary disease.

Keywords: COPD, Spriometry, FEV1, FVC.

INTRODUCTION

Obstructive diseases include conditions in which there is a resistance to airflow either through reversible factors such as bronchospasm or inflammation, or through irreversible factors such as airway fibrosis or loss of elastic recoil owing to damage to the airways and the alveoli.[1] Types include: COPD, Asthma and Cystic fibrosis.

COPD

COPD is a common disease worldwide. It is the 4th leading cause of death. Worldwide prevalence of COPD ranges from 4–6%. The prevalence in India is documented as up to 4.1%, with figures of 5% for males and 3.2% for females.[2, 4, 8]

The development of COPD is multifactorial and the risk factors of COPD include genetic and environmental factors. The interplay of these factors is important in the development of COPD.[1,8]

(I) Genetic Factor

Alpha1-antitrypsin deficiency is an established genetic cause of COPD especially in the young and it has been reported that α1-antitrypsin deficiency seen in asthma occurs in 1-2 per cent of individuals with COPD.[1]

(Ii) Environmental Factors

Tobacco smoking is the main cause of obstructive pulmonary disease. Other important environmental factors associated with COPD are outdoor air pollution, occupational exposure to dusts and fumes, biomass smoke inhalation, exposure to second-hand smoke and previous tuberculosis.[1, 6, 7]

ASTHMA

Asthma is a chronic inflammatory disorder of the airways associated with increased airway hyper-responsiveness, recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night/early morning.[6] Airway inflammation produces airflow limitation through acute bronchoconstriction, chronic mucus plug formation and airway wall swelling or remodeling.[1,6]

There are two general categories for classifying Asthma: extrinsic and intrinsic depending upon the types of stimuli that trigger attacks.

1. Extrinsic Asthma: is caused by a type of immune system response to inhaled allergens such as pollen, animal dander or dust mite particles. [1,6]
2. Intrinsic Asthma: is caused by inhalation of chemicals such as cigarette smoke or cleaning agents, taking aspirin, a chest infection, stress, laughter, exercise, cold air, food preservatives or a myriad of other factors.[1,6]

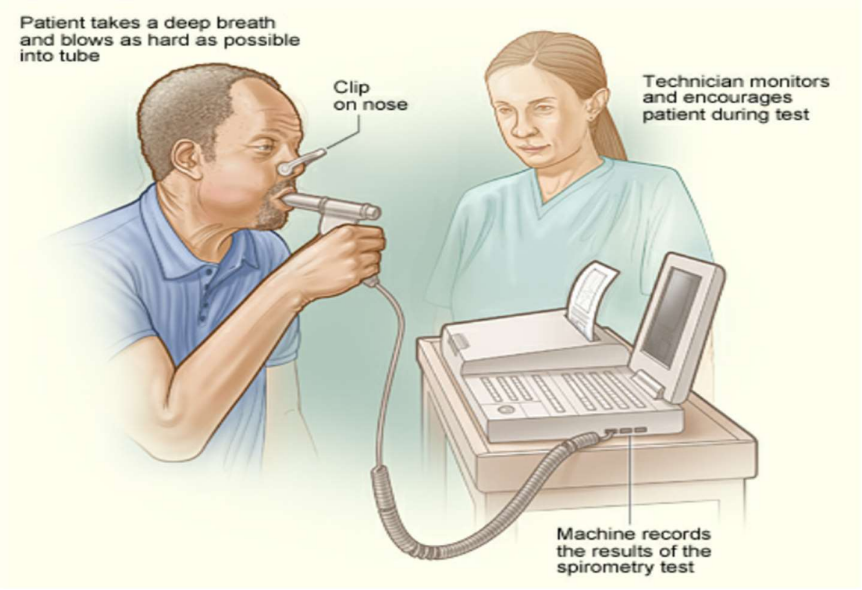


Fig 1: Performing Pulmonary Function Test.[1]

Spirometry can be helpful in determining the effects of position on ventilator functions.[5] It is the best method for detecting borderline to mild airway obstruction, which occurs early without the appearance of any symptoms or signs.[1,3] FEV1 is the most important spirometry measure for the assessment of airflow obstruction.

For a reliable diagnosis lung function tests are necessary. In pronounced cases, a simple spirometry test measuring FEV1 is sufficient.[3, 5]

Many researchers have reported significant changes in pulmonary function with positioning. Reductions of 12% for forced vital capacity and 15% for force expiratory volume in one second have been observed in normal individuals between the different body positions of sitting and slumped half lying.[3, 9] Mean expiratory pressure and peak expiratory flow rate are influenced by lung volumes and muscle length-tension relationships, which in turn are influenced by body position. The effects of breathing maneuver and sitting posture on the muscle activities of the inspiratory accessory muscles of patients with chronic obstructive pulmonary disease have been reported.[3]

Coughing and huffing are expiratory maneuvers that use high expiratory pressures and flow rates to aid airway secretion clearance.[4] Physiotherapists encourage patients to cough and huff as part of a strategy to clear airway secretions in order to minimize complications.[4] High expiratory flow rates and expiratory pressures are required for the production of strong and effective expiratory maneuvers. [5]

The objective of this study was to investigate changes in pulmonary function values of obstructive pulmonary disease patients with change in position.

Aims And Objectives

To determine the effect of different positions on FVC and FEV1 measurements in obstructive pulmonary disease patients. To find out the effect of different positions on measurement of FVC and FEV1 in obstructive pulmonary disease patients.

MATERIALS AND METHODOLOGY

Selection Of Subjects

30 subjects from the Dr. Vasantrao Pawar Medical College Hospital and Research Centre Nashik and Apollo clinic Nashik who fulfilled the inclusion criteria were enrolled in the study after giving a written consent.

Inclusion Criteria

1. Patients diagnosed having obstructive disease
2. AGE GROUP: 40 to 60 years.
3. Both Male & Female were included.
4. Patient who were clinically stable and were able to maintain test position.

Exclusion Criteria

1. Any patient who is not able to maintain test position.
2. Any previous cardiothoracic surgeries or abdominal surgery.
3. Neurological condition involving respiratory muscles.
4. Musculoskeletal injuries to chest wall.
5. Psychologically ill patients.

Sample Size: Total no. of subjects = 30
Sampling Method: convenient sampling.
Study Duration: 3 months.
Study Setting: Dr. Vasantrao Pawar Medical College Hospital and Research Centre Nashik and Apollo clinic Nashik.

Materials or equipments used

1. Spriometry machine.
2. Patient table.
3. Pillows.
4. Chair.
5. Evaluation form.
6. Pen.
7. Paper.

Outcome Measures: SPIROMETER MEASUREMENTS- (FVC, FEV1)

Procedure

Subjects were selected based on inclusion and exclusion criteria. Subjects participating in the procedure were informed with proper details of apparatus and test protocol. Signed informed consent was taken before

undergoing test. Each measurement was done three times, and the best one was analyzed. 5 min gap was maintained in between two test positions. Before the measurement, instruction and demonstration was been given to subjects on how to perform Spriometry. FVC and FEV1 were measured in supine, side lying (right), side lying (left), sitting and standing positions. The order of the body positions was randomized.[3,5] The test positions were standardized.

Following are the various positions:

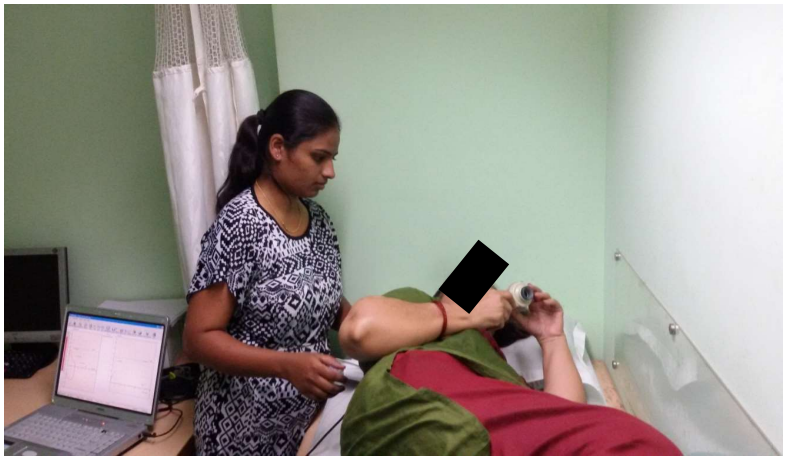
1) Sitting
2) Supine
3) Side lying (Right)
4) Side lying (Left)
5) Standing

Sitting in a chair with the trunk extended, hip and knee flexed at right angle.

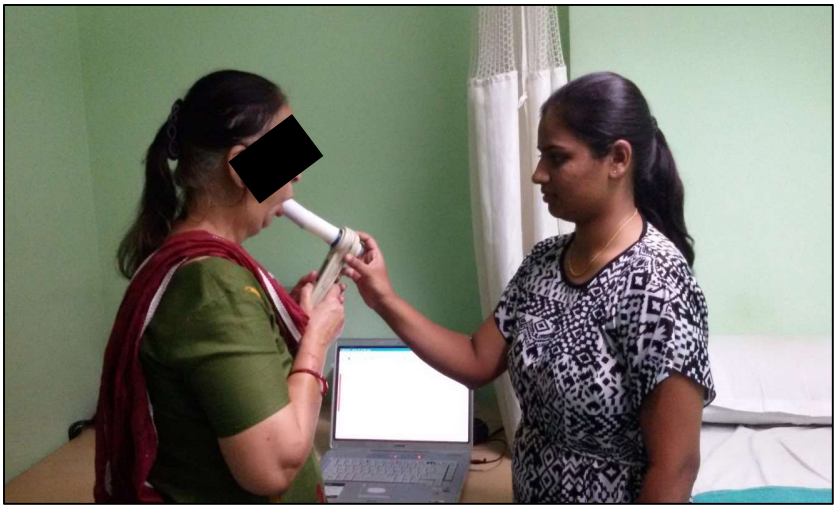
Lying on a bed with a pillow supporting the head and both legs will be extended.

(Left) Side lying: Pillows will be set under the head to maintain the body position without effort.

(RIGHT) side lying



Tanding without any support



Data analysis

Mean

To summarize the central tendency and variability of FVC and FEV1 measurements in different positions.

Repeated Measures ANOVA

Since there were more than two positions (sitting, standing, and lying), a repeated measures ANOVA was used to assess the differences in FVC and FEV1 across multiple positions within the same patients.

RESULTS

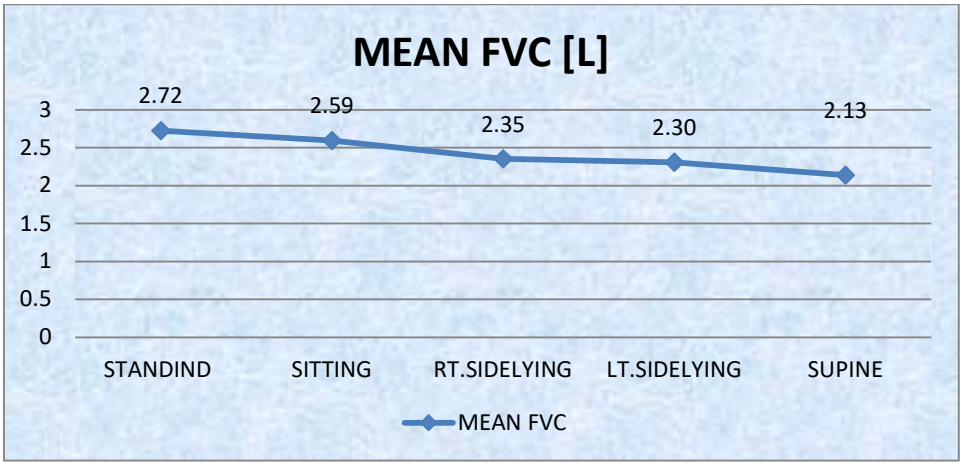
On application of ANOVA test the following values were obtained.

FOR FVC:

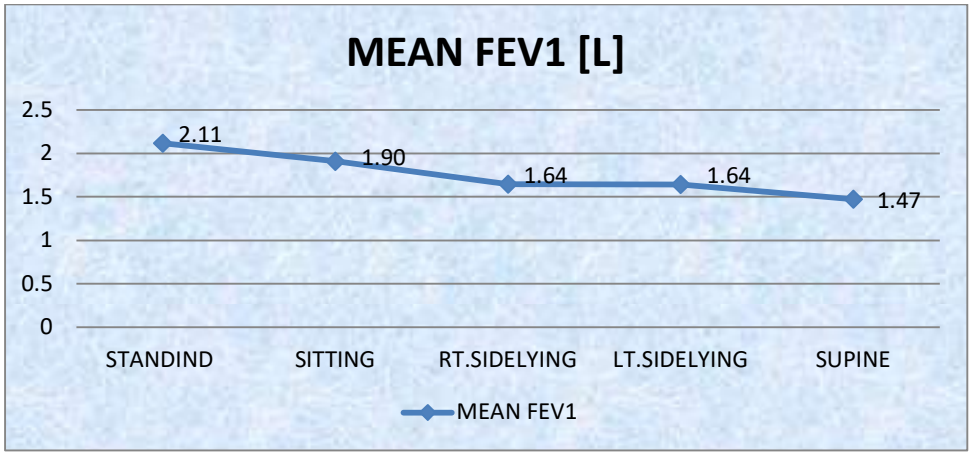
The f value obtained is 4.187 and p value obtained is 0.003 which is statically significant.

FOR FEV1:

The f value obtained is 6.343 and p value obtained is 0.006 which is statically significant..



Graph 1: On comparing the "MEAN" values from FVC in various positions.



Graph 2: On comparing the "MEAN" values from FEV1 in various positions.

DISCUSSIONS

In the present study, the effect of different positions on FEV1 and FVC values of obstructive patients was evaluated. There was a significant difference in the FEV1 values of patients between the standing and supine positions. There was also a significant difference in between these two positions.

This can be attributed to the pathology seen in patients such as loss of lung elasticity, narrowed airway, changes in muscle fiber type in respiratory muscle, that the ability to generate forced volume capacity is diminished as subject becomes more recumbent. Changes in body positions significantly affected PFT.[9] In our study standing generated significantly higher FVC and FEV1 as there is greater elastic recoil of lungs of chest wall and expiratory muscle are at a more optimal part of length tension relationship and thus are capable of generating higher FVC and FEV1.

In Standing position there is: An increase in the diameter of the main airway. Greater recoil of lung and chest wall combined with higher pressure generated by abdominal contractions.[10] This combined action pushes the air at high speed through the narrowing airway resulting in higher forced volume capacity.[11]

In side lying positions: The lung function decreases because of lower capillary volume.[10] Abdominal contents to fall forward, the dependent hemi diaphragm are stretched to a good length tension generated, while nondependent hemi diaphragm is more flattened.

In the supine position: The bases of lung are compressed by weight of heart and abdominal contents this closes the alveoli and decreases the lung compliance.[10]

The results of this study will help in the selection of the best alternative position for the PFT for measuring FEV1 and FVC. The standing position can be used for other therapeutic purposes. The purpose of study was to provide frame work for clinical decision making in the management of patients with obstructive pulmonary disease with special emphasis on body positioning. In addition physiological and scientific rationale for use of body positioning as primary intervention in remediating respiratory impairment will maximize physiotherapy efficacy.

CONCLUSION

There is an effect of various body positions on FVC and FEV1 in patients with obstructive pulmonary disease.

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