

Comparative evaluation of Thoracic Dimensions between Chronic Obstructive Pulmonary Disease (COPD) Patients and Healthy Controls

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) is one of the serious respiratory diseases of older age groups with occurrence of airway limitation leading to inflammatory responses to noxious particles. The present study was aimed at assessing the thoracic dimensions in COPD and healthy subjects.

Materials & Methods: The present study was conducted on 65 patients of COPD of both genders. 65 healthy subjects of age and gender match were also recruited for the study. AP dimension, transverse diameter and HDI were measured at ribs.

Results: The mean FEV1 in group I was 53.2 and in group II was 86.4, FVC was 48.4 in group I and 92.8 in group II and FEV1/ FVC was 45.2 in group I and 97.5 in group II. The difference was significant ($P < 0.05$). The mean AP diameter in group I was 10.8 cm and in group II was 9.21 cm, transverse diameter was 22.7 cm in group I and 21.3 cm in group II and HDI was 23.5 cm in group I and 20.6 cm in group II. The difference was significant ($P < 0.05$). The mean FEV1 in group I was 53.2 and in group II was 86.4, FVC was 48.4 in group I and 92.8 in group II and FEV1/ FVC was 45.2 in group I and 97.5 in group II. The difference was significant ($P < 0.05$). The mean AP diameter in group I was 10.8 cm and in group II was 9.21 cm, transverse diameter was 22.7 cm in group I and 21.3 cm in group II and HDI was 23.5 cm in group I and 20.6 cm in group II. The difference was significant ($P < 0.05$).

Conclusion: Authors considered COPD a leading respiratory disease of high morbidity and mortality. Authors found increase in antero- posterior, transverse diameters of thoracic cage, and HDI values in COPD patients as compared to healthy subjects.

Keywords: *Chronic obstructive pulmonary disease, Chest cage, HDI*

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is one of the serious respiratory diseases of older age groups with occurrence of airway limitation leading to inflammatory responses to noxious particles. Patients usually suffer lung hyperinflation with decreased lung elastic recoil with disease progression.¹ There are cellular events in the small airways and surrounding alveoli. Alveolar destruction with emphysema is common findings of COPD. Patient suffers alteration in thoracic cage shape characterized by increase in its dimensions. There is circular, "barrel-chest" due to increase in antero-posterior (AP) diameter of chest cage.²

Numerous studies have been done so far depicting changes in the thoracic cage of COPD patients. It has been demonstrated in various studies that there is similar residual volume (RV) and total lung capacity (TLC) in both patients with COPD and healthy person. However, this difference in opinion in chest cage dimension in healthy as well as in COPD patients need further evaluation.^{3,4} It has been observed that scanning electron microscopic study of emphysematous lung sections shows destruction of tissue, loss and collapse of regularly shaped alveoli, and enlarged alveolar ducts. There can be factors such as height, weight, age and gender that can modify chest dimensions in these patients.⁵

There is flattening of diaphragm as compared to normal subjects and the size of the zone of apposition is abridged as a result the expansion of the lower rib cage caused by diaphragmatic contraction is lesser than in normal subjects. The diaphragm fibres may run transversally inward rather than cranially especially in severe cases. This results in the contraction of the diaphragm leading to inspiratory decrease in the transverse diameter of the lower rib cage or in the volume of the lower rib cage.⁶The present study was aimed at assessing the thoracic dimensions in COPD and healthy subjects.

MATERIALS & METHODS

The present study was conducted in the department of Chest & TB. It comprised of 65 patients of COPD of both genders. 65 healthy subjects of age and gender match were also recruited for the study. All patients were explained about the study and their written consent was obtained after discussing about the study in detail. Approval from ethical committee was taken before starting the study.

Data such as name, age, sex etc. was recorded. Patients were divided into 2 groups of 65 each. Group I were COPD positive patients diagnosed with obstructive pre-bronchodilator spirometry (FEV1/FVC\0.70) GOLD guidelines. Group II subjects were healthy control.

A thorough physical examination was done in all patients. Thoracic dimensions such as average antero-posterior rib cage diameter from bases of 5th, 7th and 9th thoracic vertebrae was measured. Average transverse rib cage diameter found from maximal internal diameter of chest well at the level of 3rd, 6th, 9th pair of ribs, and average vertical height of the diaphragm from the base of T1 to the silhouette of the left and right diaphragmatic domes midway between the internal aspect of chest wall was measured in both groups. Results thus obtained were tabulated and subjected to statistical analysis. Level of significance was set below 0.05.

RESULTS

Table I Distribution of patients

Groups	Group I (COPD)	Group II (Control)
Number	65	65

Table I shows that group I comprised of COPD patient and group II had control (Healthy) subjects.

Table II Comparison of PFT in both groups

Parameters	Group I	Group II	P value
FEV1	53.2	86.4	0.02
FVC	48.4	92.8	0.05
FEV1/ FVC	45.2	97.5	0.03

Table II, graph I shows that mean FEV1 in group I was 53.2 and in group II was 86.4, FVC was 48.4 in group I and 92.8 in group II and FEV1/ FVC was 45.2 in group I and 97.5 in group II. The difference was significant (P< 0.05).

Graph I Comparison of PFT in both groups

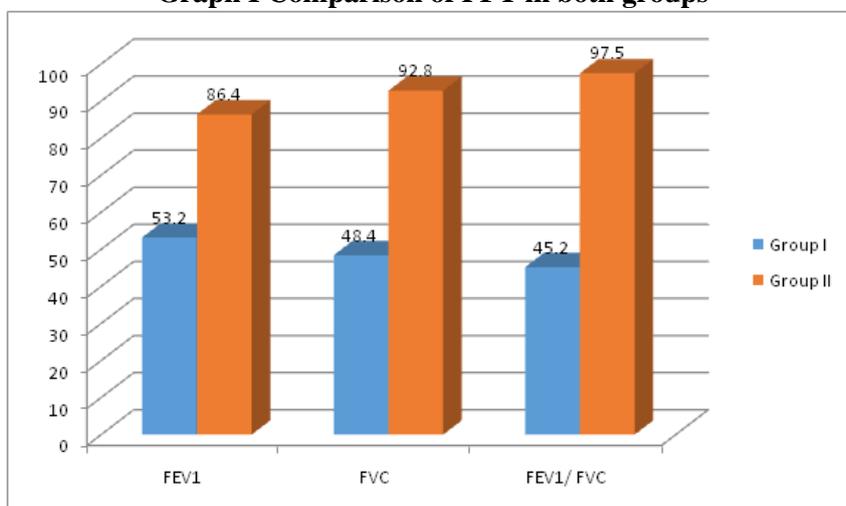
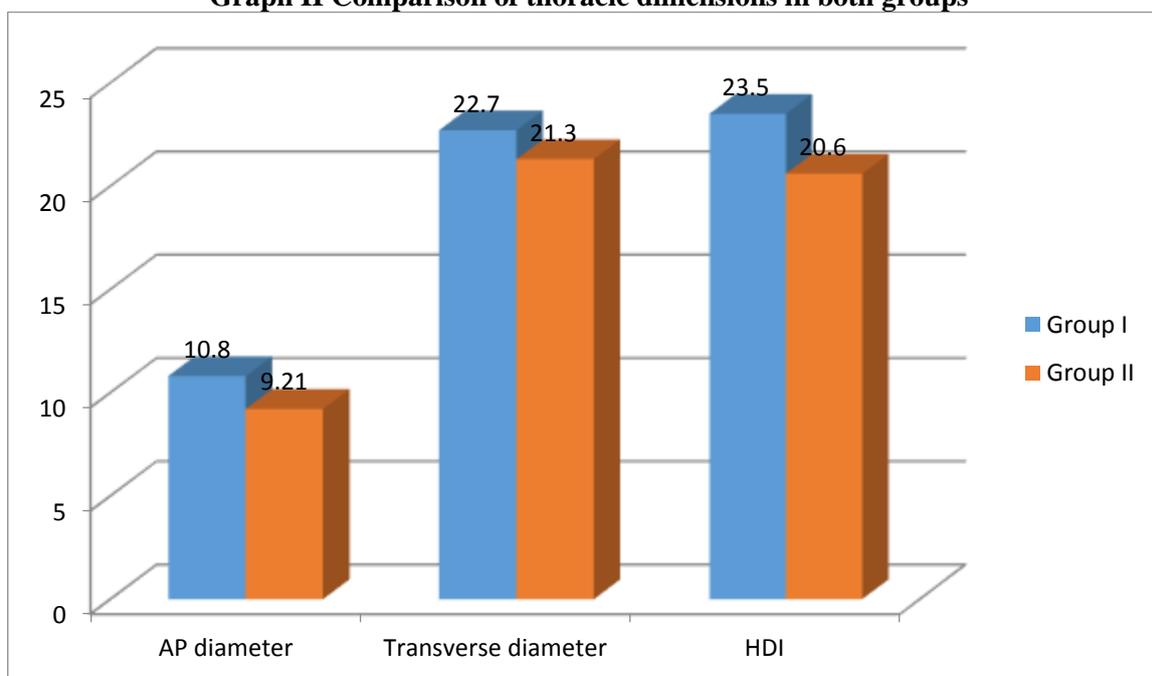


Table III Comparison of thoracic dimensions in both groups

Parameters	Group I	Group II	P value
AP diameter	10.8	9.21	0.05
Transverse diameter	22.7	21.3	0.04
HDI	23.5	20.6	0.01

Table III, graph II shows that mean AP diameter in group I was 10.8 cm and in group II was 9.21 cm, transverse diameter was 22.7 cm in group I and 21.3 cm in group II and HDI was 23.5 cm in group I and 20.6 cm in group II. The difference was significant ($P < 0.05$).

Graph II Comparison of thoracic dimensions in both groups



DISCUSSION

Chronic Obstructive Pulmonary Disease (COPD) is the disease of high morbidity and mortality. There can be variation in signs and symptoms of COPD patients.⁷ Patient suffers breathing problems, copious sputum formation and cough. COPD is the third commonly occurring respiratory disease. It is usually seen above 40 years of age with male predominance as compared to females.⁸ World Health Organization (WHO) estimated around 3.6 million human deaths resulting from COPD. It accounts for approximately 5% of total deaths worldwide. Considering its increase in number in last few years, it has been estimated that in coming 10-12 years it will become second most common deadly respiratory disease.⁹ The present study was aimed at assessing the thoracic dimensions in COPD and healthy subjects.

In our study, we included 65 patients and 65 healthy subjects which were divided into group I and group II respectively. We found that mean FEV1 in group I was 53.2 and in group II was 86.4, FVC was 48.4 in group I and 92.8 in group II and FEV1/ FVC was 45.2 in group I and 97.5 in group II. Viswambhar et al¹⁰ found that compared the thoracic dimensions such as antero posterior [AP] diameter, transverse diameter and height of diaphragm [HDI] between COPD patients and healthy control and found that the average AP diameter was significantly greater in subjects with COPD which was 10.64cms \pm 2.16cms as compared to healthy controls with 9.29cms \pm 1.47cms values. It was found that the mean transverse diameter was 22.5cms \pm 2.1cms in COPD subjects and 21.83cms \pm 2.02cms in healthy controls. The mean HDI was 23.35cms \pm 2.6cms in COPD and 20.57cms \pm 0.91cms in healthy controls.

We found that mean AP diameter in group I was 10.8 cm and in group II was 9.21 cm, transverse diameter was 22.7 cm in group I and 21.3 cm in group II and HDI was 23.5 cm in group I and 20.6 cm in group II. The difference was significant ($P < 0.05$). Lim et al¹¹ included 85 patients with COPD and 30 healthy subjects to compare thoracic cage dimension. Chest computed tomography showed the average AP diameter to be

13.1±2.8 cm in COPD patients and 12.2±1.13 cm in healthy subjects which was significantly greater in COPD patients as compared with normal controls. The ratio of AP/transverse diameter of the thoracic cage was 0.66±0.061 in COPD and 0.61±0.86 in healthy subjects. In COPD patients, the AP diameter of the thoracic cage was positively correlated with body mass index (BMI) and 6-minute walk test distance.

The elderly people show narrowing of the intervertebral disk space which causes curvature of the spine. This curvature decreases intercostal space and eventually leads to a smaller thoracic cage. Since COPD is more prevalent in elderly individuals, age-related changes in the thoracic cage are regarded to be important precipitating factors in these patients. In our study we observed that the overall diameter of the thoracic cage decreases with increasing age and rounding of the thoracic spine, resulting in greater decreases in AP diameter than the transverse diameter.¹²

The shortcoming of the study is small sample size. The effect of age and gender on occurrence of COPD was not considered and studied. The comparison of both factors with control healthy subjects could have been demonstrated different results.

CONCLUSION

Authors considered COPD a leading respiratory disease of high morbidity and mortality. Authors found increase in antero- posterior, transverse diameters of thoracic cage, and HDI values in COPD patients as compared to healthy subjects.

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