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Original Research

Thoracic dimensions of chronic obstructive pulmonary disease patients and healthy controls- A comparative study

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***ABSTRACT*:**
Background: Chronic obstructive pulmonary disease (COPD) is characterized by progressive, incompletely reversible airflow obstruction, and enhanced chronic inflammatory responses to noxious particles or gases in the airways and lungs. The present study was conducted to assess thoracic dimensions in patients with COPD. **Materials & Methods:** 84 patients with COPD and 84 healthy subjects were recruited. Thoracic dimension in both groups were compared. **Results:** The mean maximal transverse diameter in group I was 22.5 mm and in group II was 22.1 mm, mid-sagittal antero-posterior diameter was 9.2 mm in group I and 9.0 mm in group II, maximal antero-posterior diameter of the right hemithorax was 14.7 mm in group I and 14.2 mm in group II and maximal antero-posterior diameter of the left hemithorax was 14.8 mm in group I and 14.6 mm in group II. The difference was significant (P< 0.05). **Conclusion:** Thoracic dimensions were enhanced in COPD patients as compared to healthy subjects.
Key words: COPD, Thorax, Healthy

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is characterized by progressive, incompletely reversible airflow obstruction, and enhanced chronic inflammatory responses to noxious particles or gases in the airways and lungs.[1] In a significant proportion of patients with COPD, reduced lung elastic recoil combined with expiratory flow limitation eventually leads to lung hyperinflation with progression of disease. Increased lung volume and hyperinflation may cause changes in the shape of the thoracic cage in COPD patients. Therefore, it has been traditionally accepted that COPD patients exhibit increased thoracic cage dimensions, especially antero-posterior (AP) diameter, leading to a circular, "barrel-chest" appearance due to increased lung volume and hyperinflation.[2]

Among COPD due to hyperinflation, the diaphragm is flatter and lower than in normal subjects and the size of the zone of apposition is reduced. The expansion of the lower rib cage caused by diaphragmatic contraction is lesser than in normal subjects.[3] In the most severe cases of hyperinflation, the diaphragm fibres at their origin on the ribs run transversally inward rather than cranially. In this condition, the contraction of the diaphragm produces an inspiratory decrease (paradoxical motion) in the transverse diameter of the lower rib cage or in the volume of the lower rib cage.[4] Studies measuring the diameter of the thorax have reported no differences in terms of total lung capacity (TLC) and residual volume (RV) between patients with emphysema and healthy subjects.[5] The present study was conducted to assess thoracic dimensions in patients with COPD.

MATERIALS & METHODS

The present study was conducted among 84 patients with COPD of both genders. All were informed regarding the study and their written consent was obtained.

Data related to patients such as name, age, gender etc. was recorded. Equal number of healthy subjects of both genders was also recruited for comparison. Patients were divided into 2 groups. Group I were COPD patients and group II were control subjects. Thoracic cage diameters were measured it at three anatomical levels (thoracic vertebrae level 3, 6, and 9). For each thoracic segment, several thoracic cage diameters were measured using an electronic caliper at CT scan. The maximal transverse diameter (A), mid-sagittal AP diameter (B), the maximal AP diameter of the right (C), and left hemithorax (D) were measured. Pulmonary function tests were also compared. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Assessment of thoracic dimensions

Thoracic dimensions (mm)	Group I	Group II	P value
Maximal transverse diameter	22.5	22.1	0.94
Mid-sagittal antero-posterior diameter	9.2	9.0	0.72
Maximal antero-posterior diameter of the right hemithorax	14.7	14.2	0.84
Maximal antero-posterior diameter of the left hemithorax	14.8	14.6	0.91

Table II, graph I shows that mean maximal transverse diameter in group I was 22.5 mm and in group II was 22.1 mm, mid-sagittal antero-posterior diameter was 9.2 mm in group I and 9.0 mm in group II, maximal antero-posterior diameter of the right hemithorax was 14.7 mm in group I and 14.2 mm in group II and maximal antero-posterior diameter of the left hemithorax was 14.8 mm in group I and 14.6 mm in group II. The difference was significant (P< 0.05).

Graph I Assessment of thoracic dimensions

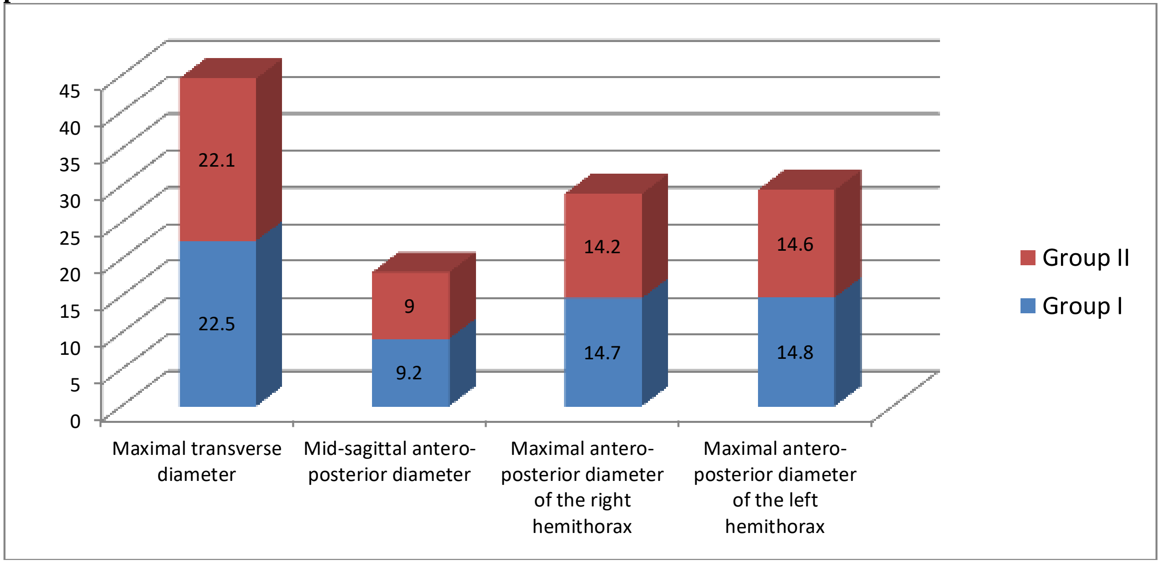
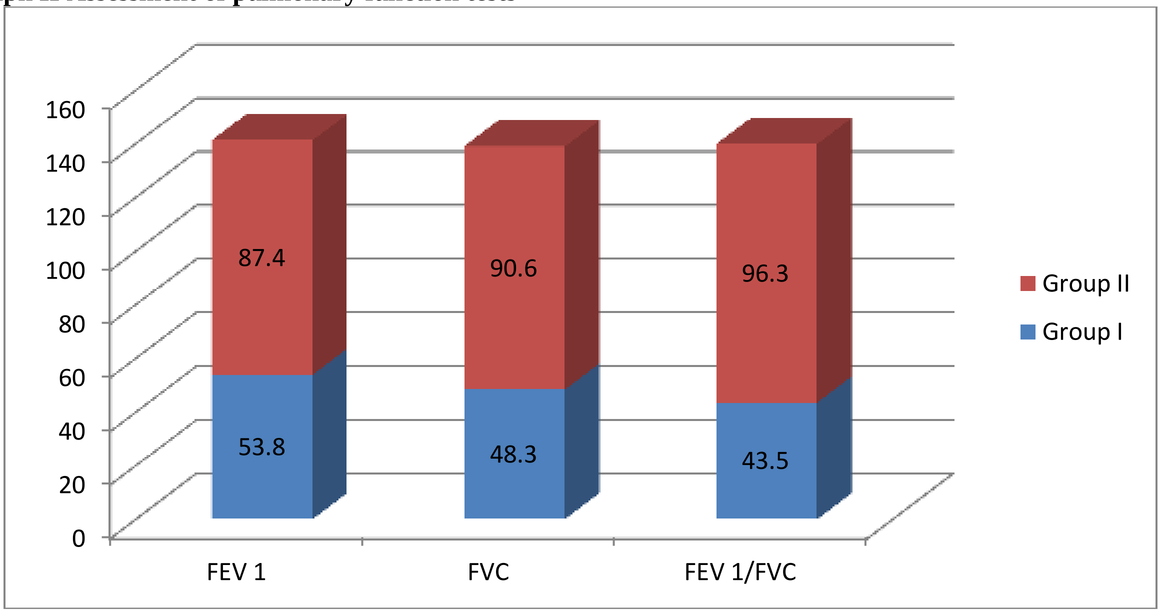


Table II Assessment of pulmonary function tests

Pulmonary function tests	Group I	Group II	P value
FEV 1	53.8	87.4	0.02
FVC	48.3	90.6	0.04
FEV 1/FVC	43.5	96.3	0.05

Table II, graph II shows that mean FEV 1 in group I was 53.8 and in group II was 87.4, FVC was 48.3 in group I and 90.6 in group II and FEV 1/FVC was 43.5 in group I and 96.3 in group II. The difference was significant (P< 0.05).

Graph II Assessment of pulmonary function tests



DISCUSSION

Chronic obstructive pulmonary disease (COPD), a heterogeneous collection of diseases with differing causes, pathogenic mechanisms, and physiological effects is one of the leading causes of death worldwide.[6] This marked heterogeneity impedes identification of subpopulations at risk for accelerated progression, thwarting therapeutic advances. Most COPD studies have included populations with mean ages older than 60 years.[7]

It is a preventable and treatable disease with some significant extrapulmonary effects that may contribute to the severity in individual patients.[8] Its pulmonary component is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases.[9] Chronic obstructive pulmonary disease (COPD) is a preventable and treatable disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and is associated with an abnormal inflammatory response of the lungs to noxious particles or gases, primarily caused by cigarette smoking. Although COPD affects the lungs, it also produces significant systemic consequences.[10] The present study was conducted to assess thoracic dimensions in patients with COPD.

In present study, we observed that mean maximal transverse diameter in group I was 22.5 mm and in group II was 22.1 mm, mid-sagittal antero-posterior diameter was 9.2 mm in group I and 9.0 mm in group II, maximal antero-posterior diameter of the right hemithorax was 14.7 mm in group I and 14.2 mm in group II and maximal antero-posterior diameter of the left hemithorax was 14.8 mm in group I and 14.6 mm in group II. Kilburn et al[11] compared the thoracic dimensions Antero posterior [AP] diameter, Transverse diameter and Height of diaphragm [HDI] between COPD patients and healthy controls. The average AP diameter was significantly greater in subjects with COPD [10.64 cms ± 2.16 cms] compared to healthy controls [9.29cms ± 1.47cms]. The difference was statistically significant [$p < 0.001$].

We found that mean FEV 1 in group I was 53.8 and in group II was 87.4, FVC was 48.3 in group I and 90.6 in group II and FEV 1/FVC was 43.5 in group I and 96.3 in group II. Reddy et al[12] in their study 70 subjects (25 healthy nonsmokers, 25 healthy smokers, and 20 COPD) aged between 18 and 70 years participated in the study. Upper and lower chest expansion (CE) measurements (2 levels) are performed with cloth inch tape. Intrarater (between day) and interrater (within-day) reliability of CE measurements was evaluated by two examiners. Lung function parameters, forced expiratory volume in first second (FEV1), forced vital capacity (FVC), FEV1/FVC, and vital capacity (VC) were measured using a computerized spirometer. The intrarater reliability for upper and lower CE showed very good agreement with intraclass correlation (ICC) values between 0.90 and 0.93 for upper CE and 0.85 to 0.86 for lower CE. The interrater reliability for upper CE showed good to very good agreement with ICC values ranging between 0.78 and 0.83, and lower CE showed very good agreement with ICC values ranging between 0.82 and 0.84. Upper and lower CE showed a significant and positive correlation with all lung function parameters, with strong correlation with FEV1/FVC ($r = 0.68$). Upper and lower CE measurements with inch tape showed good intra- and interrater reliability and reproducibility in healthy nonsmokers, healthy smokers, and COPD subjects. Compared to upper, lower CE correlated well with the lung function parameters. Upper and lower CE may be more useful in clinical practice to evaluate chest mobility and to give indirect information on lung function but interpretation with caution is required when considering implementation into clinical setting.[12]

CONCLUSION

Authors found that thoracic dimensions were enhanced in COPD patients as compared to healthy subjects.

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