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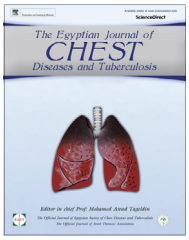

ORIGINAL ARTICLE

Radiologic and physiologic correlation in apparently healthy smoker

Hala Mohamed Shalaby Samaha [a,*], **Amir Monir Ali** [b]

[a] *Chest Diseases Department, Faculty of Medicine, Mansoura University, Egypt*
[b] *Radiology Department, Faculty of Medicine, Mansoura University, Egypt*

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KEYWORDS

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Abstract *Background:* Pulmonary damage induced by smoking acts slowly and may or may not show symptoms which are related to pulmonary function or radiological effect.

Objectives: To correlate findings on history, chest X-ray, pulmonary function test high resolution computed tomography (HRCT) scans and to determine whether these findings may be useful in diagnosis of lung damage.

Methods: This study comprised 50 subjects (10 healthy volunteers, 40 smokers) who underwent history taking, CXR, pulmonary function tests (spirometry and lung volumes) and both inspiratory and expiratory HRCT.

Results: Pulmonary function measurement in studied groups showed obstructive pattern with highly significant difference. Chest X-ray showed hyperinflation in 38% in group II, 79% in group III, 90% in group IV. Mosaic perfusion was present in 3 cases 19%, 7 cases 50%, 5 cases 50%, paraseptal emphysema was present in 7 cases 44%, 11 cases 78%, 7 cases 70%, centrilobular emphysema was present in 4 cases 25%, 6 cases 43%, 4 cases 40% and bullae was present in 7 cases 44%, 8 cases 57%, 5 cases 50% in groups II, III, VI, respectively.

Wheezes and cough showed significant negative correlation with FEF_{25-75}% and PEF, while dyspnea showed positive correlation with bullae. Cough showed significant correlation with radiological finding, mosaic perfusion and centrilobular emphysema.

There was significant correlation between tests of small airway and radiological finding in chest X-ray and high resolution computed tomography.

Conclusion: We conclude that there was a functional and pathological impairment in the lung as cigarette consumption increases and chest symptoms in smoker appears to be related to small airway affection.

* Corresponding author.
E-mail address: samahahala@yahoo.com (H.M.S. Samaha).

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Introduction

Smoking-induced lung disease is a complex group of disorders, varying from the well known entity of chronic obstructive pulmonary disease to more recently described interstitial lung diseases. The obstructive ventilatory defect that defines chronic obstructive pulmonary disease reflects the presence of varying degrees of lung parenchymal destructive changes and airway inflammation. Different degrees of severity of small-airway and parenchymal reaction to cigarette smoke characterize several diseases strongly linked to tobacco consumption, [1].

In severe COPD, emphysema is usually associated with airflow obstruction, but the coexistence of these conditions is not inevitable, previous studies suggest that loss of lung elastic recoil may result in airway obstruction or have no such effect. The relationship between emphysema and airflow obstruction is therefore more complex and less clearly defined than often thought [2].

CT scanning is a minimally invasive tool employed to characterize these structural changes *in vivo* and has been demonstrated repeatedly to be correlated with measures of airflow obstruction. CT imaging has also been employed to objectively classify an individual as having either emphysema or airway-predominant disease, and there is some suggestion that a subject's relative burden of airway and airspace disease may not be the result of totally independent processes. [3]

The aim of this study was to determine the correlation between PFTs and radiological findings in assessing the early diagnosis of pulmonary damage in current cigarette smokers (none of whom were known to have COPD or other obstructive lung diseases).

Materials and methods

This study comprised 50 subjects (10 healthy volunteers, 40 smokers) who were recruited from smoking outpatient clinic at the Mansoura University hospital from January 2010 to September 2010. The subjects were included in the study after providing written informed consent. The 40 smokers were subdivided into 3 groups according to the degree of tobacco exposure (pack/year index) which is related to the risk of diseases [4]. All study subjects were age matched.

Group I

This group included 10 healthy non smoker volunteers. They were 10 males with mean age 39.1 ± 9.5. The control subjects were lifelong nonsmokers and had no historyl or clinical evidence of lung disease, no respiratory tract infection during and one month preceding the study or complaining of other medical problems and had normal chest radiography and spirometry.

Group II

This group included 16 low risk tobacco smokers with mean age 35 ± 7.8.

Group III

This group included 14 moderate risk tobacco smokers with mean age 38 ± 3.5.

Group IV

This group included 10 high risk tobacco smokers with mean age 42 ± 6.1.

All smoker subjects fulfilled the following selection criteria.

All subjects were considered eligible for the study if they were conformed to the following criteria.

Inclusion criteria

1- Only cigarette smoking.
2- No symptoms suggestive of chest infection 1 month before the study.
3- No chest pain, no haemptysis.
4- No history of asthma, tuberculosis or occupational exposure to chemicals or allergen.
5- No other systemic disease hepatic, renal disease, diabetic, malignancy autoimmune disease.
6- Lung function tests and HRCT scan were performed on the same day.

Evaluation included age, smoking history, CXR, PFTs, inspiratory and expiratory thoracal HRCT. Subjects were classified according to cumulative cigarette consumption using the Brinkman smoking index (BI), defined as packs of cigarettes/day × years 4.

Pulmonary function testing using computerized spirometry apparatus (JAEGER Germany)

I. Spirometry and related tests (slow vital capacity) (V_T, ERV), forced vital capacity (flow/volume loop) FVC, FEV1 (percentage of predicted), FEV1/FVC, FEF 50% (percentage of predicted).
II. Body plethsymograph

Total lung capacity (TLC), residual volume (RV) and RV/TLC ratio.

High Resolution computed Tomography (HRCT).

All the CT studies were performed on TOSHIBA ASTEION.

Using a high resolution technique: collimation 2 mm, images were reconstructed using a high spatial frequency algorithm and a 512 × 512 matrix. The scan time was 0.75 second, KV120, mAS150. The images were analyzed on a window width of 1600 Hounsfield unit (HU) and window level-500 (HU). No contrast media were used.

Five sections were obtained from an initial scanogram: aortic arch, main Carina, 1 cm below carina, level of the pulmonary veins and 2 cm above the right hemidiaphragm. Data were collected at full inspiration with additional scans at five levels on expiration for assessment of air trapping, mosaic perfusion, bullae and hyperlucent area.

Data were analyzed using spss (Statistical package for Social Sciences) version16.

Normally distributed data were presented as mean ± SD.

Paired *t*-test was used for comparison within groups.

F-test (one way Anova) was used to compare between more than two groups.

Spearman's and pearson's correlation coefficient was used to test correlation between variables. $P < 0.05$ significant, $P < 0.01$ highly significant, $P < 0.001$ very highly significant.