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TANAFFOS

Pattern of Pulmonary Function Test Abnormalities in Anthracofibrosis of the Lungs

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Background: The objective of this study was to discuss the spirometric characteristics of anthracofibrosis which is a from of bronchial anthracosis associated with deformity.

Materials and Methods: Forty anthracofibrosis subjects who were diagnosed with bronchoscopy were enrolled in this prospective study. Static and dynamic spirometry plus lung volumes and diffusion capacity were measured in this group and compared to a healthy control group.

Results: Dyspnea (95%), cough (86%) and wheezing (68%) were the most frequent clinical findings. Spirometry showed significant decrease in all parameters including VC (FVC), FEV1, FEV1/FVC, FEF25-75 and FEF25-75 /FVC. The low value of FEV1/FVC and FEF25-75 and the increment of RV were in favor of obstructive patterns in 95% of subjects. Improving the obstruction with bronchodilator was not significant and diffusion capacity was mostly normal.

Conclusion: Anthracofibrosis should be added to the list of chronic obstructive pulmonary diseases.

Key words: Anthracosis, Anthracofibrosis, DLCO, Lung volume, Spirometry

INTRODUCTION

Bronchial anthracosis is the black discoloration of bronchial mucosa. This old disease is increasingly reported in Asia, especially rural areas (1, 2). Sometimes this is an accidental finding during bronchoscopy but in a more severe form called "anthracofibrosis" it may cause obliteration and deformity of bronchial lumen. This form is important due to its clinical resemblance to lung cancer (3) and association with tuberculosis (4,5). Moreover, our experience (6) showed episodes of severe dyspnea attacks and wheezing that were superimposed on the previous slowly progressive disease; very similar to acute exacerbation of COPD albeit without a history of cigarette smoking. During bronchoscopy some of these subjects showed localized involvement that required no therapy and some of them showed extensive involvement that caused clinical symptoms. Pulmonary function tests (PFT) by non-invasive methods are able to show which subjects suffer from widespread involvement of airways, a condition which makes them circumspect for bronchoscopy.

The objective of this study was to discuss the spirometric characteristics of anthracofibrosis which is a from of bronchial anthracosis associated with deformity.

MATERIALS AND METHODS

Based on the fact that anthracofibrosis is diagnosed bronchoscopically, anthracofibrosis subjects were recruited from patients who underwent bronchoscopy for their lung disease and had a confirmed diagnosis of anthracofibrosis.

The control group consisted of healthy volunteers from Ghaem Hospital staff, who were never smokers and did not suffer from any pulmonary symptoms.

Demographic characteristics and pulmonary symptoms of patients were studied by taking their history and conducting a physical examination before the bronchoscopy. The pulmonary function test consisted of static and dynamic spirometry, lung volumes and lung diffusion of Carbon monoxide (DLCO). A body plethysmograph with DLCO measurement (Sensormedics, Model Vmax 6200, California Co. Ltd., USA) was used. The control group was evaluated by standard spirometry, lung volume, DLCO and methacholine challenge test to ensure they are completely normal.

All subjects gave their informed consent and the study was approved by the Ethics Committee of Mashhad University of Medical Sciences.

Sample size was 40 subjects for each anthracofibrosis and the control group (considering 11% frequency of anthracofibrosis in our region) (6). The Kolmogorov-Smirnov test was done to evaluate the homogeneity of samples. Descriptive data were quoted by reporting frequency of symptoms and arithmetic mean and standard deviation (SD) for age and spirometric data. Comparisons of groups were performed by the two-tailed Student's t-test or logistic regression analysis. Significance was accepted at $P<0.05$.

RESULTS

The mean age of anthracofibrosis subjects was 69.1±9.5 years, which was significantly older than the control group (38.5±12.9, $P<0.001$). Male to female ratio was 10/9. Smoking was reported by 6.7% (100% male subjects) of the anthracofibrosis subjects and traditional rustic baking by 28% (78% of the female subjects).

Dyspnea (95%) and cough (86%) were the most frequent symptoms. Phlegm was found in 17% and hemoptysis was not reported. Physical exam revealed wheezing in 68%, crackle in 23% and both of them in 9%.

Spirometry showed significant decrease in all parameters including VC (FVC), FEV1, FEV1/FVC, FEF_{25-75} and FEF_{25-75} /FVC (Table 1). The low value of FEV1/FVC and FEF_{25-75} was in favor of obstructive pattern and the mean FEV1 showed that most patients could be classified into the severe stage. The maximum value of FEV1/FVC was 77% that was observed in only 2 subjects and all other subjects showed FEV1/FVC less than 75%. The mean post bronchodilator changes was not significant (1.14±0.11%, $P<0.05$). Similarly, RV showed a significant increase; however, this finding was not repeated for TLC. DLCO and DLCO/VA were mainly within the normal range and did not show a significant difference from the control group.

Table 1. Comparison of spirometry, lung volume and DLCO between anthracosis subjects and normal control group

	Anthracosis		Control	
	Value	% Pred.	Value	% Pred.
VC (L)	2.15±0.61*	76±21.6*	3.8±0.75	100.1±17.1
FVC (L)	2.17±0.69*	75.8±19.5*	3.9±0.85	104±12.2
FEV1 (L)	1.28±0.46*	57.3±18.4*	3.2±0.68	100.7±10.1
FEV1/FVC (%)	60.6±13.3*	-	82.1±5.7	-
FEF_{25-75} (L/S)	0.73±0.37*	25.7±14*	3.4±0.97	88.9±20.5
FEF_{25-75}/FVC	0.37±0.23*	0.34±0.21*	0.9±0.24	0.86±0.23
TLC (L)	5.4±2.1	104±29.1	5.9±1.3	106±19
RV (L)	3.2±1.97*	144±80	1.9±0.8	121±52
DLCO (mmol/kPa/min)	6.4±4.5	75±19.9		
DLCO/VA (mmol/kPa/min/l)	1.6±0.84	107±24		

* Significant difference of parameter between anthracosis and control group.

Statistical analysis did not show any correlation between the severity of alterations in spirometric parameters, severity of clinical findings and extensiveness of anthracofibrosis in bronchoscopy.

DISCUSSION

The present study represents the pulmonary function tests of 40 anthracofibrosis subjects in the chronic phase. The results indicated a severe obstructive pattern that did not improve significantly with bronchodilator. Lung volumes increased mildly, which ruled out significant air trapping in their lungs. Normal lung diffusion parameters were in favor of exclusive bronchial involvement and significant alveolar infiltration was ruled out. These findings were universal and the severity of disease according to clinical and bronchoscopic findings did not affect the spirometry results.

Anthracofibrosis is an old disease that had been forgotten until the end of the twentieth century, when its clinical importance emerged (7). The association of this disease with tuberculosis has been reported (8). Since then, the reports about the frequency of anthracofibrosis found during routine bronchoscopy (1,9) and clinical findings, especially dyspnea and wheezing, have increased (4,5). Among non-invasive diagnostic procedures, greatest attention has been focused on computed tomography to find a means for diagnosis of this disease through a non-invasive method instead of bronchoscopy (10). Limited information is available about pulmonary function tests. In a large clinical study by Amoli (11) (who used only spirometry) approximately two-thirds of anthracosis subjects showed obstructive patterns while one-third of them revealed restrictive patterns. Three different studies in Korea reported obstructive pattern as the most frequent pattern (47%-62%) (12,13,14). But the frequency of normal and restrictive patterns was higher than the rate in the present study and Amoli's study (11). Our explanation for high frequency of obstructive pattern is that our inclusion criteria allowed entry of anthracofibrosis subjects, but in Korean and Amoli's studies all anthracosis subjects including those showing black discoloration without bronchial deformity were entered. Further studies in Korea showed than mean FEV1/FVC parameter in BAF subjects was approximately 69% and in favor of obstructive pattern (12, 15).

Another study using ultra-thin bronchoscope showed that anthracosis tends to originate from the distal bronchi (16). In anthracofibrosis, when occlusion of bronchi with anthracosis is visible, we have to consider that all the distal bronchial lumen (except alveolar structure) may be involved. The results of PFT in the present study are in favor of this conclusion. Our experience showed that bronchodilators such as theophylline, salbutamol and salmeterol were effective. Inhaled corticosteroids have not been very useful but sometimes oral corticosteroids are life saving in severe exacerbations.

In conclusion, anthracofibrosis is an obstructive lung disease sparing alveolar structure that poorly improves with bronchodilators. Identification of the nature of black substances deposited in tissue macrophages can help in better management of this disease.

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