LUNG PARENCHYMAL CHANGES IN ANKYLOSING SPONDYLITIS; DEMONSTRATION WITH HIGH RESOLUTION COMPUTED TOMOGRAPHY

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ABSTRACT

In this study, we aimed to identify lung parenchymal changes in ankylosing spondylitis (AS) with high resolution computed tomography (HRCT). We prospectively studied 23 patients with documented AS. In all patients, detailed clinical history including respiratory complaints are obtained. Following physical examination and pulmonary function tests (FEV1, FVC), HRCT imagining is performed in all cases. The images are then analyzed for mediastinal, parenchymal and costovertebral changes. HRCT demonstrated pathology in 22 of the patients (95%). There were 8 patients with apical fibrosis and 1 patient with interstitial lung disease. Thirteen patients had costovertebral fusion. Pulmonary function tests were normal in 12 patients, restrictive in 8 patients and obstructive in 3 patients. In conclusion, lung parenchyma in AS demonstrate a wide spectrum of changes from discrete nodules to severe fibrosis. A possible association between interstitial lung disease and AS exist; requiring vertical studies done with large patient groups.

Key words: Ankylosing spondylitis, HRCT, Lung parenchyma, Costovertebral ankylosis, Pulmonary function test

ÖZET

ANKİLOZAN SPONDİLİTTE AKCİĞER PARENKİM DEĞİŞİKLİKLERİ, HRCT İLE GÖSTERİLMESİ

Bu çalışmada, yüksek rezolüsyonlu kompüterize tomografi (HRCT) ile, ankilozan spondiliteki akciğer parenkim degişikliklerinin tanımlanması amaçlanmıştır. Ankilozan spondilitli 23 olgu, prospektif olarak değerlendirilmiştir. Tümünde, solunum yakınmalarını da içeren ayrıntılı klinik öykü alınmıştır. Fizik bakı ve pulmoner fonksiyon testlerinin (FEV1, FVC) ardından tüm olgularda HRCT yapılmıştır. Görüntüler, mediastinal, parenkimal ve kostovertebral değişiklikler açısından incelenmiştir. Olguların 22(%95)'inde HRCT ile patolojik değişiklikler gösterilmiştir. 8 olguda, apikal fibrozis ve 1 olguda, interstisiyel akciğer hastalığı saptanmıştır.

13 hastada, kostovertebral füzyon bulunmuştur. Pulmoner fonksiyon testleri, 12 hastada normal, 8 hastada restriktif, 3 hastada obstrüktif olarak değerlendirilmiştir. Sonuç olarak, ankilozan spondilitte akciğer parenkimi, ayrı ayrı nodüllerden ciddi fibrozise kadar geniş bir spektrum gösterir. İnterstisiyel akciğer hastalığı ile ankilozan spondilit arasında olası bir ilişki vardır ve büyük hasta gruplarında yapılan vertikal çalışmalar gerektirir.

Anahtar sözcükler: Ankilozan spondilit, HRCT, Akciğer parenkimi, Kostovertebral ankiloz, Pulmoner fonksiyon testi

INTRODUCTION

AS is a chronic inflammatory multisystem disease that affects chiefly the skeleton. Thorax involvement is not uncommon (1). Studies of changes affecting the lung parenchyma in AS have until now been based on plain radiographies, pulmonary function tests and bronchoalveolar lavage (2,3). Nonetheless, with the advent of high resolution computed tomography, detailed descriptions of pulmonary parenchyma

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changes in disease effecting lung, have been possible (4,5). In literature, there is only one report on HRCT findings of pulmonary changes in AS (6). Here, we aimed to analyze the spectrum of changes in lungs. As the superiority of HRCT over plain radiographies have been proven in almost all disease effecting pulmonary parenchyma, we did not compare the plain radiography findings with HRCT.

MATERIAL and METHOD

Twenty-five patients (21 male, 4 female) were subject to this study. All patients' clinical history were reviewed from their hospital records for disease duration and for disease like tuberculosis that may effect lung parenchyma. From each patient, smoking history, occupation history and respiratory complaints were obtained. Physical examination of the patients was performed by a physiatrist. One patient with a history of pulmonary tuberculosis and one patient previously hospitalized for pneumonia were excluded from the study. Thus, the study enrolled over 23 patients (19 male, 4 female). The mean age of the group was 45.8 years. The duration of the disease changed between 2 and 34 years with a mean of 15.8 years. In 9 patients, the disease had been present for less than 10 years. Twelve patients were current cigarette smokers, 4 patients were ex smokers, 7 patients were none smokers (Table 1).

Table 1. Demographic features of the group

	Number	Range	Mean
Sex Men Women	 19 4		
Age		21-72	45.8
Disease duration (year)		2-34	15.8
Smokers	12		
Ex-smokers	4		
Non-smokers	7		

Following physical examination, pulmonary function tests; forced expiratory volume in 1s (FEV1), forced vital capacity (FVC) were performed. Depending on the results of these tests, the patients are categorized as having obstructive disease (FEV1<75%, FEV1/FVC<70%), restrictive disease (FEV1<75%, FVC%predicted<75%, FEV1/FVC>70%) or normal (FEV1>75%, FVC%predicted>75%, FEV1/FVC>70%).

Changes in lung fields were searched with HRCT (GE 9600 Highlight Advance, GE Medical Systems, Milwaukee) imaging technique. Images, obtained with 10 mm. scan space, 1.5 mm. slice thickness, 28-32 cm field of view, 120 kV and 280 mA were reconstructed with 512x512 matrix using bone algorithm. The HRCT scans were then evaluated for the following changes by a chest radiologist. **Bronchiectasis:** bronchus or bronchiole with a lumen diameter greater than the lumen of accompanying artery. **Peribronchial thickening:** bronchial wall thickness greater than one sixth of the lumen diameter. **Emphysema:** Areas with decreased lung attenuation without visible wall. **Septal thickening:** linear parenchymal opacities, 1-2 cm in length, perpendicular to and abutting the pleura. **Subpleural band:** curvilinear band paralleling pleural surface **Parenchymal band:** nonvascular parenchymal linear band longer than 3 cm. **Honeycomb appearance:** interlacing cystic spaces with thickened wall. **Ground-glass appearance:** areas of increased parenchymal attenuation without distortion in bronchi and vessels **Nodule:** parenchymal and subpleural nodules smaller than one cm. **Lymphadenopathy (LAP):** mediastinal lymph nodes with diameter greater than one cm in any direction. **Apical fibrosis:** apical fibrotic change distorting the pulmonary parenchyma, including cavity formation. In addition to above mentioned changes pleural thickening was searched and costovertebral joints were evaluated for ankylosis, bridging and resorption.

Table 2. Pulmonary HRCT findings

HRCT Findings	Number	%
Bronchiectasis	8	34.7
Peribronchial thickening	9	39.1
Apical fibrosis	8	34.7
Emphysema	15	65.2
Septal thickening	5	21.7
Subpleural band	9	39.1
Parenchymal band	4	17.3
Honeycomb appearance	1	4.3
Ground-glass appearance	9	39.1
Nodule	11	47.8
LAP	15	65.2
Pleural thickening	9	39.1
Costovertebral joints		
Normal	5	21.7
Ankylosis	13	56.5
Bridging	2	8.6
Resorption	3	13

RESULTS

In 22 of 23 patients, there were parenchymal changes. The distribution of HRCT findings are summarized in Table 2.

Apical fibrosis was present in eight patients. The upper lobe changes in two patients were severe with cavity formation and pleural retraction. In six patients, the changes were mild to moderate and mainly composed of irregular fibrotic changes distorting the parenchyma. All were unilateral except one.

The most common change in the whole group was emphysema. Six of the emphysemas were in patients with apical fibrosis. In eight patients, there were bronchiectasic changes. Two of them were in the form of traction bronchiectasis and six of them were in primary form. Three out of five septal thickening, two out of nine peribronchial thickening and three out of eleven nodules were observed in patients with apical fibrosis. The nodules were in the form of subpleural and/or fissure micronodules. The patient with honeycomb appearance in posterior of right lower zone, had also apical lobe fibrosis. From nine patients with pleural thickening four had associated apical fibrosis.

Fifteen of the 23 patients had mediastinal lymph nodes all ranging less than 1.5 cm in anteroposterior and laterolateral directions. Pulmonary function tests were normal in 12 patients. Eight patients had restrictive and three patients had mild obstructive pulmonary function test pattern. Thirteen patients had manyfast costovertebral fusion. Two patients had bridging between costal elements and vertebrae. In three patients, there were resorptive degenerative changes without ankylosis and/or bridging. In five patients costovertebral junctions were normal. In eight patients with apical fibrosis, all had costovertebral fusion except the patient who had only resorptive changes without fusion.

DISCUSSION

AS is an inflammatory disease of unknown etiology characterized by prominent inflammation of spinal joints and adjacent structures. The prevalence of AS varies from 0.2% to 1.4% in different populations. Males appear to be disproportionately affected by AS compared to females (3:1) (7). The age range differs from 20 to 40 years but usually begins in midtwenties. Skeletal manifestations of the disease is well-known (8). Pathologically, synovitis, osteitis and erosion of sacroiliac, apophyseal and costovertebral articulations are seen. Iritis, aortic insufficieney, pericarditis, amyloidosis, inlammatory bowel disease are some of the pathologic conditions reported in association with AS (8,9). Paraspinal ligament calcification with syndesmophyte formations are late changes. Fusion in thoracic spine involvement results in increased kyphotic curvature, thus chest expansion diminishes progressively. Pulmonary parenchyma involvement is an uncommon extra articular manifestation of AS. Hamilton, Campbell, Davies and Wolson described in separate papers the association of upper lobe pulmonary fibrosis with ankylosing spondylitis (10-13). The largest study group belongs to Rosenow et al. Among 2080 patients with AS, they reported 26 patients with upper lobe fibrosis (14). Fealon et al have been the first to describe HRCT changes (6).

In our study, pulmonary parenchymal changes were present in almost all cases except one patient who had a disease duration for nine years. Apical fibrosis without history of tuberculosis and pulmonary disease hospitalization were found in 8 of the 23 patients (Figure 1).

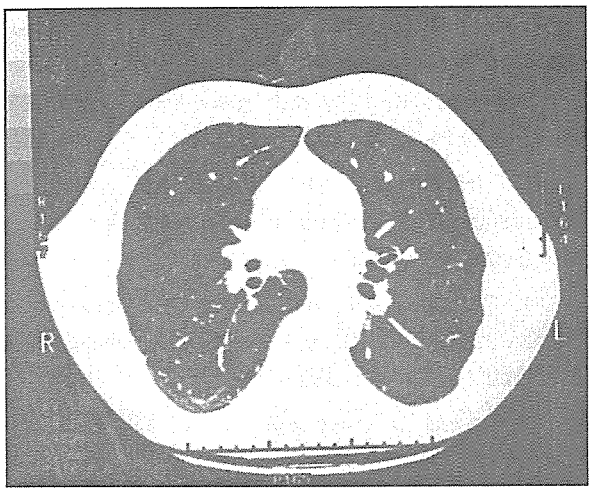

Figure 1. Bilateral apical parenchymal fibrotic changes are seen. The changes are more prominent on right apex.

Thus these changes were thought to be due to ankylosing spondylitis. All the processes were unilateral except in one patient and no aspergilloma was detected.

Airway changes like emphysema and peribronchial thickening were strikingly frequent. These changes observed in HRCT scans could be attributed to smoking. Nonetheless, while from 16 current and ex smokers 11 had bronchiectasis or bronchial thickening, 3 out of 7 nonsmokers had bronchiectasis or bronchial thickening. Beside airway changes, two patients who were in their early thirties and non smokers had subpleural band formation without significant lung disease history. Nodules were present in other two non smokers. Therefore the changes reported here cannot be explained by smoking habits alone and should be interpreted as minor interstitial reactions in the lung. As they are neither severe nor extensive, they cannot be regarded as interstitial lung disease also.

Although it is believed that involvement of the lower half of the lung fields are unusual, we have observed honey comb appearance in lower fields of one patient suggesting interstitial involvement (Figure 2). As chest biopsy was not routinely performed in AS in our hospital, we were not able to prove it with biopsy. Nonetheless, the radiologic appearance was typical for interstitial lung disease. The patient was a heavy smoker and had restrictive pulmonary function test. Costovertebral ankylosis was present.

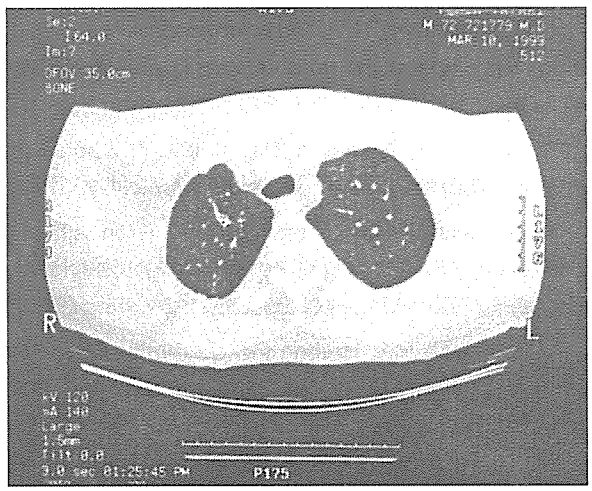

Figure 2. Honeycomb appearance is seen on right posterior subpleural area.

The pulmonary changes were more frequent in patients with ankylosis but less in patients who had normal joints. In thirteen patients with costovertebral ankylosis, the pulmonary function tests were normal in four patients, restrictive in seven patients, and obstructive in two patients. In group with normal joints, the pulmonary function tests were also normal. These results show the importance of thoracic rigidity due to costovertebral joint involvement as expected. Nonetheless, the presence of septal thickening, subpleural band formation, nodules and peribronchiar thickening in group with normal costovertebral joints suggests association of primary parenchymal involvement. All the lymph nodes detected in patients were in the range of 1 to 1.5 cm. Thus, they can not be excepted as pathologic.

In conclusion, Fenlon et al. reported the association of interstitial lung disease with AS, which could have been missed in plain radiographies till now (6). We have also detected interstitial changes ranging from mild to interstitial lung disease that could not be explained only with costovertebral changes or tobacco consume. Nonetheless, prospective, vertical studies with control group are needed for more definite outcome.

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