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The effects of respiratory functions on disease activity, functionality, spinal mobility and quality of life in patients with ankylosing spondylitis

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Abstract
We aimed to determine the relationship between the pulmonary functions with disease activity, functionality, spinal mobility and quality of life in patients with ankylosing spondyilitis (AS). PATIENTS AND METHOD: 52 patients (44 male, 8 female) who were diagnosed as AS in Şişli Etfal Education and Research Hospital physical medicine and rehabilitation policlinics according to the Modified New York criteria, participated in our study. The demographic characteristics and smoking habbits were questioned, the chest expansion was measured. The functional activity, disease activity, spinal mobility measurement were evaluated by BASFI, BASDAI,BASMI (Bath Ankylosing Spondylitis functional, disease activity, metrology ındex),and the life quality was evaluated by life quality spesific to the disease (ASQOL). The respiratory functions were measured by spirometry. 52 patients in 31 patients restrictive, and in 1 patient mixed pattern pulmonary involvement were detected. There was no determined no significant difference between who detected and not detected restrictive lung disease regarding age, gender, body mass index, lung expansion (LE), history of smoking ($p>0.005$). Pulmonary function tests results and LE of smoker and no smoker patients were similar. While LE was found to be positively correlated with FEV1 and FVC ($p<0.01$); there was negative correlation between BASFI and BASMI ($p<0.01$). But significant relationship was not determined LE and BASDAI ($p>0.05$). FEV1 and FVC values were negative correlation with LE, BASFI and BASMI ($p<0.05$). There was no significant correlation between BASDAI and FEV1, FVC values ($p<0.01$)). There were no statistically significant relationship between ASQOL and the pulmonary function tests. ($p>0.05$) As pulmonary involvement in AS patients was detected, we have found its effects on disease activity, patients functionality and spinal mobility in the results of our study. But as expected there was no significant relationship between pulmonary function tests and life quality.

Keywords: Ankylosing spondyilitis, pulmoner functions, Bath Ankylosing Spondylitis Index, quality of life

Introduction

Ankylosing spondylitis (AS) is a chronic, systemic and inflammatory rheumatismal disease, which affects primarily axial skeleton (sacroiliac joints and spine). In the early stage of the disease, the typical and chronic symptom is sacroiliac joint. Over time, the characteristics of discovertebral, apophyseal, costovertebral and costotransverse joints and paravertebral ligamentous structures are being influenced [1]. Aside from axial involvement, particularly the involvement of glenohumeral joint and another peripheral joint, lung, cardiovascular and renal system and extra-articular organs, such as eyes, are observed [2,3].

Following the thoracic spine involvement, costovertebral joint fusion is developed in the costosternal area, after enthesis, sternoclavicular and manubriosternal inflammation. As a result of this, thorax could not expand and chest expansion (CE) is reduced. At the same time, the fibrocystic changes in lung parenchyma, particularly in the upper lobe occur [4]. As a consequence of these, while vital capacity and total lung capacity in the pulmonary function tests are reduced, a restrictive type respiratory failure, which is characterized by an increase in residual capacity and residual functional capacity, is developed.

The impaired quality of life, resulting from pain, stiffness, and limitations in body functions could gradually become worse by the existence of pulmonary involvement. Thus, it is important to detect the pulmonary involvement at an earlier stage, to keep away the patient from triggering factors like smoking, to begin pulmonary rehabilitation at an earlier stage and to reduce functional limitations of the patient in order to improve the quality of life and prevent possible pulmonary complications.

With this purpose, it is aimed to evaluate the effects of AS on respiratory system as well as its relation to the disease activity, patient functionality, spinal mobility and the quality of life.

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Material and Method

This study involved 52 patients diagnosed with AS according to 1984 modified New York criteria, who were referred to Sisli Etfal Training and Research Hospital, Clinic of Physical Medicine and Rehabilitation. The patients who had an uncontrolled cardiopulmonary disease, had a history of tuberculosis or malignancy, had a history of asbestos or silica exposure, had neurologically affected, and the patients who were using any assistive devices for ambulation that causes difficulties in cooperation were excluded from the study.

The informed consent was obtained from all patients in order to recruit them into the study.

The patients' names, age, gender, body mass index (BMI), disease background, history of smoking, the duration of the disease were recorded. The clinical status of every patient was evaluated according to the indices presented in more detail below. The validity and reliability studies for all questionnaires used in this study were available.

Functional activity: It was assessed by BASFI (Bath Ankylosing Spondylitis Functional Index). BASFI, which includes eight items about daily life activities and two items about the daily hassles, was designed to evaluate the functional status of the patients and follow up them. Total BASFI score was assessed between 0-10 [5,6].

Disease activity: It was evaluated with BASDAI (Bath Ankylosing Spondylitis Disease Activity Index). BASDAI consists of six questions related to five major symptoms including fatigue, spinal pain, arthralgia or joint swelling, localized vulnerable areas and morning stiffness. Total BASDAI score was calculated by transforming 0-50 scale into 0-10 scale [7,8].

Spinal Mobility: It was assessed by BASMI (Bath Ankylosing Spondylitis Metrology Index). BASMI is an index which consists of measurements of tragus-wall distance, cervical rotations, lumbar lateral flexions, modified Schober and intermalleolar distance. Each measurement is scored between 0-2 and the total BASMI score varies between 0-10 [9].

The Quality of Life: It was evaluated with the quality of life instrument specific to ankylosing spondilitis (ASQOL). ASQOL is a questionnaire, consisting of 18 items with a yes/no answer format. The scoring varies between 0 and 18, and the lower scores indicate that patient's quality of life was less affected by the disease [10].

Pulmonary function tests: It was measured in the sitting position with spirometer device, having a portable printer. Following the test, vital capacity (FVC), forced expiratory volume in one second (FEV 1), and the ratio of FEV1/FVC were recorded. After the percentages of FEV and FVC were found to be fewer than 80% and concordantly, the ratio of FEV/FVC % was discovered to be normal or higher, the restrictive pulmonary involvement, which limits the expansion of thorax wall, was considered [11].

Statistical analysis was carried out with "SPSS 16.0 software package". The mean and standard deviations of parametric data were calculated. The comparisons according to the history of smoking and gender were performed with Mann-Whitney U test. In comparisons of patients with a history of smoking or not, the independent two samples t-test was used. For the correlation analysis, Spearman and Pearson's analysis were utilized according to what extent parameters were normally distributed or not. The significant statistical value was accepted as $p<0.05$.

Results

For the scope of the study, 52 voluntary AS patients, including of 44 males and eight females were evaluated. The demographic characteristics and results of the clinical assessment were presented in Table 1.

Table 1. Demographic characteristics, clinical assessment and pulmonary function tests results

	Mean value ±standart deviation
Age (year)	36.5 ± 10.3
Disease duration (year)	10.3 ± 8.1
BMI (kg/m^2)	25.1 ± 4.1
GE (cm)	2.76 ±1.5
FVC (L/sn)	3.59 ± 0.83
FEV1 (L/sn)	3.11 ±0.73
% FVC	79.2 ±13.5
%FEV1	84.5 ±14.5
FEV1/FVC (%)	107.1 ±8.6
BASDAI (0-10 score)	3.48 ±2.16
BASMI (0-10 score)	3.71 ±2.43
BASFI (0-10 score)	2.84 ±2.58
ASQOL (0-18 score)	6.5 ±5.75
History of smoking (%)	40.3

In 31 patients, restrictive pulmonary involvement was detected. According to the results of the spirometer , there was no difference between the patients having a restrictive pulmonary disease or not regarding age, gender, BMI, chest expansion and history of smoking ($p>0,05$). The pulmonary function test results and chest expansion measurements of the patients with a history of smoking or not were found to be similar ($p>0,05$). While a positive relationship ($p<0,01$) was detected between CE and the spirometric measurements (FEV1 and FVC), there was a negative correlation between BASFI and BASMI($p<0,01$). However, no relationship was detected between CE and BASDAI ($p>0,05$).

A negative relationship was identified between FEV1 and FVC values and between BASFI and BASMI ($p<0,01$). There was a significant negative correlation between FEV1 and FVC as well as with BASDAI ($p<0,05$). No significant relationship was found between ASQOL and pulmonary function tests ($p>0,05$)(Table-2).

Table-2. Bath Ankylosing Spondylitis Indexs, quality of life and chest expension parameters relationship between pulmonary functional tests results (p values)

	FVC	FEV1	%FEV1/FVC
BASFI	-0.004*	-0.003*	0.41
BASMI	-0.003*	-0.004*	0.84
BASDAI	-0.035	-0.011	-0.61
ASQOL	-0.11	-0.13	0.69
CE	0.00*	0.00*	-0.32

*p<0.01

Discussion

In our study, which evaluates the effects of respiratory functions on the disease activity, functionality, spinal mobility and quality of life in Ankylosing spondylitis patients, it was detected that the presence of pulmonary involvement has a negative impact on the disease activity, patient's functional status and the spinal mobility in Ankylosing spondylitis.

The pulmonary involvement was first demonstrated as an upper lobe pulmonary fibrosis in 1941 [12]. Although the diffusion capacity, pulmonary compliance and arterial blood gasses were found to be normal, the existence of restrictive type respiratory failure was demonstrated. One of the useful tests for detecting pulmonary involvement in these patients is spirometric measurement. In the studies, the abnormalities were identified in the pulmonary function tests and the measurements of diffusing capacity of the lung for carbon monoxide (DLCO) [13-16]. Feltelius and colleagues suggested that a reduction in pulmonary volume and the normal ratio of FEV1/FVC were indicative of a restrictive pulmonary disease [17]. In our study, the restrictive pulmonary disease was detected in 31 of 52 patients (52.6%).

It was difficult to determine whether pulmonary involvement in Ankylosing spondylitis results from smoking or related to disease process [15]. It was known that the changes could be occurred in lung parenchyma due to smoking in healthy people [18]. However, in AS patients the rate of pulmonary involvement, which could raise up to 65-70%, increases further by smoking, and the smoking was considered as one of the aggravating factors of AS progress [14,16,19,21]. In a study carried by Ward and colleagues, the functional disability of 326 AS patients was assessed by Bath Ankylosing Spondylitis Index and the relationship of some risk factors, including smoking, with functional limitations was investigated [21]. It was indicated that in smoker AS patients, the functional disabilities were found to be higher. In our study, when the group with respiratory dysfunction was compared to the group with a normal respiratory function regarding disease duration and smoking addiction, no significant difference was detected.

Patients with a diagnosis of Ankylosing spondylitis had functional limitations comparing to normal people, and one of the reasons for this was identified as pulmonary involvement. In a study by Dincer and colleagues [11] a negative relationship was detected between FEV1 and BASFI scores, similar to our study. This result also demonstrates the importance of pulmonary function test (PFT), especially in identifying the independence of AS patients in daily life activities. El Maghraoui et al determined that pulmonary functions were related to disease activity, axial joint involvement, and the functioning [22]. In our study, a negative relationship was determined between FEV1 and FVC values and between BASFI, BASMI and BASDAI values, as consistent with the literature.

In Ankylosing spondylitis, chest expansion has a limited value in determining restrictive pulmonary disease. Nevertheless, chest expansion (CE) is an indicative of the severity of the disease in AS [16]. At the same time, the longer the duration of the disease is, the more reduction is expected in CE. When the chest expansion is reduced, the activity in the diaphragm, sternocleidomastoid muscle, pectoral and scalene muscle is increased. This picture is compensatory for restrictive pulmonary involvement. In the studies, it was identified that CE, FVC and FEV1 values in AS patients were lower comparing to the control group [6]. A significant relationship was detected between CE and SFT in AS patients [16,17]. Again in a study by Cerrahoglu and colleagues, in which the effects of CE on functional status were investigated by accepting CE as a sign of pulmonary involvement, it was demonstrated that CE has an association with functional status [23]. In a study carried out with 48 AS patients by Uzunca and Ozdemir, it was observed that CE has an association with BASFI [24].In a study by Durmus et al, a connection of CE with BASFI and BASMI was identified, while no relationship was found with BASDAI [25]. Similar to all these results, in our study, while CE pulmonary function tests were found to be associated with BASFI and BASMI, no relationship was identified with BASDAI.

It was known that in patients with Ankylosing spondylitis diagnosis, the restrictive pulmonary disease could have a negative impact on the quality of life in addition to pain, stiffness, and physical limitations. Soyyigit et al have identified a moderate correlation between pulmonary function tests and health and physical function subscales of quality of life questionnaire [11,26]. In our study, we could not find any relationship between the quality of life parameters, specific to the disease and the pulmonary function values.

As a result, in AS patients pulmonary involvement is common. The primary complaints of the patients involve symptoms of pain, stiffness, and physical disability. In the later stages of the disease, a limitation in the chest wall movements and a reduction in pulmonary functions were occurred. In our study, in addition to identifying the presence of pulmonary involvement, we identified its

impact on the disease activity, patient functionality, and spinal mobility. In the earlier stages of the disease, it should be kept in mind that pulmonary capacity should be monitored carefully as well as clinical parameters, and the exercise plans should be designed to include chest movements along with all spine.

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