Article

FVC, FEV_1 and $FEV_{1/}$ FVC % in Rheumatoid Arthritic Female and their Relationships with Duration of the Disease

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Abstract

Background: Rheumatoid Arthritis (RA) is the most common inflammatory disorder mediated through the immune system, affecting joints and various organs including lungs. Pulmonary dysfunction in RA patients has been reported. **Objective:** To observe FVC, FEV_1 and $FEV_{1/}$ FVC % in female patients of RA and their relationships with duration of the disease. **Methods:** This cross-sectional study was carried out in the Department of Physiology, BSMMU, Dhaka, from January to December 2009 on 90 RA female patients of 30-50 years age (Group B). For comparison, 30 age and BMI matched apparently healthy subjects (Group A) were also studied. According to the duration of disease, RA patients were subdivided into B_1 (newly diagnosed), B_2 (3-5 years) and B_3 (6-10 years). They were selected from the Out Patient Department of Physical Medicine of Bangabandhu Sheikh Mujib Medical University, Dhaka. FVC, FEV_1 and FEV_1/FVC% of all the subjects were measured by a digital MicroDL spirometer. Results were expressed as percent of predicted value. For statistical analysis One-Way ANOVA, Unpaired Student's 't' test and Pearson's correlation coefficient test were performed, as required. **Results:** The mean percentage of predicted values of these lung function parameters in the healthy female subjects and newly diagnosed (B_1) RA patients were within normal ranges. The mean percentage of predicted values of all the spirometric variables were significantly lower in the patients in B_3 compared to those in B_2 (FVC $p<0.01$, FEV_1 $p<0.01$), B_1 (FVC $p<0.05$, FEV_1 $p<0.05$, FEV_1/FVC% $p< 0.001$) and A (FVC $p<0.01$, FEV_1 $p<0.001$, FEV_1/FVC% $p<0.001$), except FEV_1/FVC% in B_3 vs B_2 which was lower but nonsignificant. Again these same parameters were significantly lower in B_2 in comparison to B_1 (FVC $p<0.001$, FEV_1 $p<0.001$, FEV_1/FVC% $p< 0.001$) and A (FVC $p<0.001$, FEV_1 $p<0.05$, FEV_1/FVC% $p<0.001$). In addition all the ventilatory variables had significant ($p<0.001$) negative correlation with durations of disease except FVC in B_1, which was significant at $p<0.01$ level. **Conclusion:** This study reveals that pulmonary functions may be lower in patients of RA and the lung function is inversely related to the duration of disease.

Key Words: FVC; FEV_1, Rheumatoid Arthritis

J Bangladesh Soc Physiol. 2010 June; 5(1): 8-13
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http://www.banglajol.info/index.php/JBSP

Introduction

Rheumatoid Arthritis (RA) is the most common inflammatory disorder mediated through the immune system. Typical clinical features of RA include symmetrical, deforming small and large joint polyarthritis, associated with systemic disorder and extra-articular features [1]. Women are 2 to 3 times more affected than men. Onset may be at any age, most frequently occur between 35 to 50 year[2].

The etiology of Rheumatoid Arthritis is still unknown, but there is evidence for genetic predisposition to the disease[3]. A good number

of investigators reported association of abnormal pulmonary function tests in RA patients [4-8].

Pulmonary involvement contributes significantly to the morbidity and mortality in patients with Rheumatoid Arthritis and is the second most common cause of death [6]. It has been observed that Rheumatoid Factor (RF) value was significantly higher in the presence of lung involvement in RA patients [9].

Researchers agreed that immune mediated processes in Rheumatoid Arthritis are vital to the inflammatory processes in the lung. Immune complex deposits in the lung interstitium and alveolar walls leads to alveolar macrophage activation [9]. Inflammatory processes on air sacs or alveoli and their supporting structures make them fibrosed resulting in impaired lung function[10, 11].

Some investigators claimed chronic airway disease was the predominant one [12] but small airway involvement may appear as the commonest form of pulmonary involvement of rheumatoid lung disease though Interstitial Lung Disease (ILD) is the most common form of pulmonary abnormality [9]. Rheumatoid pulmonary disorders may range from pleurisy, pulmonary nodules and interstitial pulmonary fibrosis to airway disease [5].

Some researchers reported that lung functions tests were correlated with duration of disease [13,14]. Large numbers of subjects in Bangladesh are affected by Rheumatoid Arthritis. Usually the patients are treated by the physician with an aim to relieve the symptoms, ignoring the prevention of complications. Therefore, pulmonary involvements in RA may remain undiagnosed which can be easily diagnosed by simple pulmonary functions tests. Therefore, pulmonary functions tests in these patients are vital for early detection of associated pulmonary involvement in RA patients.

Many researchers have investigated pulmonary functions in this group of patients in other countries [6,7,8,15,16]. To the best of our knowledge no such study has been under taken to explore the pulmonary function status in RA patients in Bangladesh. Therefore the present study was conducted to observe some aspects of lung function status in the groups of RA patients and also to evaluate their relationships with duration of this disease.

Methods

This cross-sectional study was carried out in the Department of Physiology, BSMMU, Dhaka, from January to December 2009 on 90(ninety) female patients of Rheumatoid Arthritis (according to American Rheumatism Association 1987 revised criteria)[17] aged 30-50 yrs (Group B). For comparison 30 age and BMI matched apparently healthy female subjects were also studied (Group A). Based on duration of disease, study group was further divided into Group B_1 (newly diagnosed), Group B_2 (2-5 years) and Group B_3 (6 -10 years). All the patients of study group (Group B) were selected from the Out Patient Department (OPD) of Physical Medicine, BSMMU. Subjects with history of anyform of tobacco, asthma, COPD, pulmonary fibrosis, pneumonia, hypertension (>140/90 mm of Hg), diabetes mellitus (Serum glucose 2hr after breakfast>11mmol/L), any heart disease, chronic renal failure (Serum creatinine>1.5mg/dl), severe anemia (Hb<11mg/dl) were excluded from the study. After selection all the subjects were thoroughly informed about the aim, objectives and benefits of this study to encourage their voluntary participation. informed written consent was taken from each of them. A detail personal, family and medical history were taken and a thorough physical examinations of each subject was done. All the information were recorded in a prefixed questionnaire. Then the subjects were taken to the Respiratory Laboratory for pulmonary function test. The detailed procedure of spirometric examination was explained to the subject and the values of FVC,FEV_1 and FEV_1/ FVC% were obtained according to the manufacturer's instruction by a Digital Micro DL Spirometer manufactured by Clement Clarke International Ltd .Edinburgh Way ,Harlow,Essex

CM20 2TT England. Data were analyzed by One-way ANOVA, Independent sample 't' test and Pearson's Correlation Coefficient test, as applicable.

Results

The mean ± SD age and BMI of all subjects were almost similar and the groups were matched for age and BMI.(Table I).

Table I: Age and BMI in different groups (n=120)

Groups	n	Age (Year)	BMI (Kg/m^2)
A	30	38.2±6.02	22.56±1.07
B_1	30	38.03±5.96	22.79±1.45
B_2	30	37.7±4.84	22.72±1.45
B_3	30	40.93±5.21	22.70±1.30

Statistical analysis:

Groups	P value	
A vs B_1 vs B_2 vs B_3 [a]	0.094[ns]	0.925[ns]
A vs B_1 [b]	0.827[ns]	0.193[ns]
A vs B_2 [b]	0.096[ns]	0.095[ns]
A vs B_3 [b]	0.440[ns]	0.271[ns]
B_1 vs B_2 [b]	0.162[ns]	0.793[ns]
B_2 vs B_3 [b]	0.284[ns]	0.547[ns]
B_1 vs B_3 [b]	0.613[ns]	0.763[ns]

Data were expressed as mean ± SD.

a = one way ANOVA, b = independent sample t - test.

BMI = Body Mass Index.

Group A: Apparently healthy subjects (control group)

Group B : Rheumatoid Arthritis (study group)

B_1 : Newly diagnosed patients.

B_2 : Patients with 3-5 yrs.

B_3 : Patients with 6-10 yrs.

ns = non significant (p > 0.05)

n = number of subjects

The mean percentage of predicted values of all these parameters were significantly lower in B_2 and B_3 in comparison to those of group A. Though these values were lower in B_1 compared to A but it was statistically not significant. Again these values were significantly lower in B_2 than those of B_1. In addition these values were also lower in B_3 then those of B_2 but the differences were statistically significant ($p<0.05$) only for FVC and FEV_1. (Table II).

Table II: Percentage of predicted values of FVC, FEV_1 and FEV_1/ FVC in different groups (n=120)

Groups	n	FVC (% of predicted value)	FEV_1 (% of predicted value)	FEV_1/FVC (% of predicted value)
A	30	92.97±11.02	94.93 ± 8.12	105.07 ± 7.26
B_1	30	90.9 ± 7.03	89.4 ± 5.99	101.37 ± 6.96
B_2	30	87.6±21.87	73.03 ± 12.79	88.6 ± 17.64
B_3	30	63.3±13.97	57 ± 14.57	83.9 ± 20.57

Statistical analysis:

Groups	P value		
A vs B_1 vs B_2 vs B_3 [a]	0.000***	0.000***	0.000***
A vs B_1 [b]	0.560 [ns]	0.075 [ns]	0.846 [ns]
A vs B_2 [b]	0.000***	0.04*	0.000***
A vs B_3 [b]	0.009**	0.000***	0.000***
B_1 vs B_2 [b]	0.000***	0.000***	0.000***
B_2 vs B_3 [b]	0.024*	0.04*	0.972
B_1 vs B_3 [b]	0.028*	0.000***	[ns]0.001***

Data were expressed as mean ± SD.

a = one way ANOVA, b = independent sample t - test.

Group A: Apparently healthy subjects (control group)

Group B: Rheumatoid Arthritis (study group)

B_1 : Newly diagnosed patients.

B_2 : Patients with 3-5 yrs.

B_3 : Patients with 6-10 yrs.

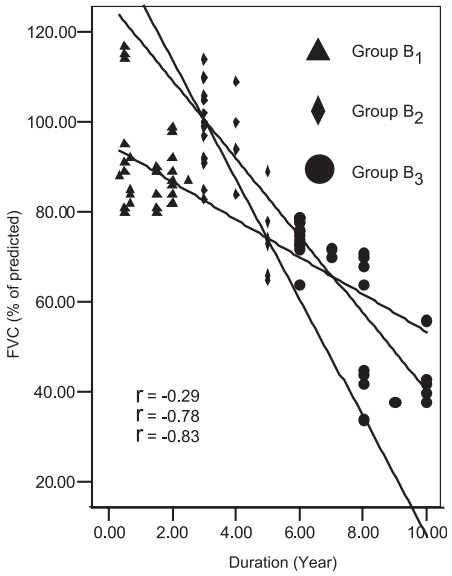
*** = significant ($p<0.001$)

** =significant ($P<0.01$)

* = significant ($P<0.05$)

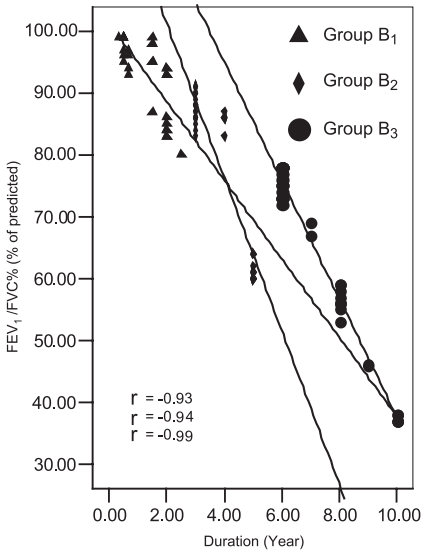
ns = non significant (p > 0.05)

Correlations of all these study variables with the duration of the disease in RA patients showed FVC (B_1 r=-0.29, B_2 r=-0.78, B_3 r=-0.83), FEV_1 (B_1 r=-0.74, B_2 r=-0.93, B_3 r=-0.99) and FEV_1/FVC % (B_1 r=-0.93, B_2 r=-0.94, B_3 r=-0.99) significantly ($p<0.001$) and negatively correlated with the duration of disease in all the study groups (Figure 1,2,3,).



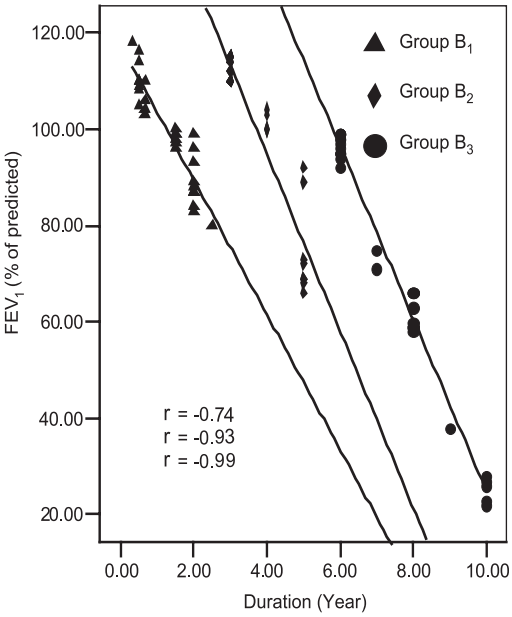
B_1: Newly diagnosed RA female patients
B_2: 3-5 years duration RA female patients
B_3: 6-10 years duration RA female patients

Figure 1: Correlation of percentage predicted value of FVC with duration of Rheumatoid Arthritis in study groups (n=90)



B_1: Newly diagnosed RA female patients
B_2: 3-5 years duration RA female patients
B_3: 6-10 years duration RA female patients

Figure 3: Correlation of percentage predicted value of FEV_1/FVC% with duration of Rheumatoid Arthritis in study groups (n=90)



B_1: Newly diagnosed RA female patients
B_2: 3-5 years duration RA female patients
B_3: 6-10 years duration RA female patients

Figure 2 : Correlation of percentage predicted value of FEV_1 with duration of Rheumatoid Arthritis in study groups (n=90)

Discussion

The present study was undertaken to observe some aspects of spirometric variables of pulmonary functions in female patients with Rheumatoid Arthritis. In this study, values of FVC, FEV_1 and FEV_1/ FVC % of healthy subjects were within normal limit and were almost similar to those reported by different investigators of other countries [8,15,18] as well as in our country [19,20].

In the current study, all the study parameters in patients of RA with different durations were significantly lower than those of healthy subjects but these values are almost similar in newly diagnosed patient and healthy subjects. Several investigators from different countries[6,8,9,21] observed almost similar findings. Again, these parameters were significantly lower in patients with 3-5 years duration compared to that of newly

diagnosed and also in 6-10 years duration than those in 3-5 years duration patients. Similar findings were observed by several investigators[17,22].

Significant negative correlations of FVC, FEV_1 and FEV_1/FVC% with the duration of disease in all patients of Rheumatoid Arthritis in the present study is similar to those observed by other investigators[14,15].

Various mechanisms have been proposed for these observed changes in lung function in Rheumatoid Arthritis. Some investigators suggested that the inflammatory process might spread from other organs to the lung interstitial tissue causing lung inflammation and dysfunction[7]. Continuous systemic inflammatory process brings modification of structural and functional features of bronchi and bronchioles[13]. Again mucosal edema secondary to pre-existing airways inflammation may lead to bronchial narrowing and may cause airways obstruction[18]. Immune complex deposits in the alveolar wall of patients may also cause progressive idiopathic interstitial fibrosis[23].

Decreased percentage of predicted values of FVC, FEV_1, FEV_1/FVC%, in patients of Rheumatoid Arthritis in comparison to healthy subjects are most likely due to pulmonary fibrosis and bronchial narrowing as a result of chronic inflammation in lung tissue. Again decreased lung compliance in RA patients may be due to costochondral joint disease or respiratory muscle weakness.

Reduced values of all the lung function parameters in the present study are suggestive of the coexistence of obstructive and restrictive features in the RA patients of the present series which is most likely due to the interstitial fibrosis and airway inflammation as a consequence of the chronic inflammatory processes involved in rheumatoid arthritis. Moreover, in this study, the significant negative correlations of the study variables with different duration of Rheumatoid Arthritis and the significant lowering of these parameters in patients with longer duration of RA also revealed the fact that duration of inflammation influences the degree of deterioration lung function.

Conclusion

This study reveals that pulmonary functions may be lower in patients of Rheumatoid Arthritis and the lung function is inversely related to the duration of disease.

Acknowledgement

Authors of this study are thankful to the authority of Department of Physical Medicine, BSMMU, for their nice cooperation for sample collection.

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