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A Comparative Study on Pulmonary Function in Females with Rheumatoid Arthritis

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Abstract: The current study was focused to find out the relation of pulmonary function (PFT)in female with Rheumatoid arthritis (RA).The study was carried on 100 females with RA in the age group 20-60 years, who fulfill the Revised American Rheumatism Association Criteria (1988). Patients with respiratory illness, smoking habits, treated with methotrexate were excluded from this study. Patients were well examined for height, weight, pulse rate, respiratory rate and blood pressure. These patients were assessed for pulmonary function-Forced vital capacity (FVC) and Maximum Voluntary Ventilation (MVV) in "SPIROLAB II". The results showed that there was negative correlation between duration of disease and the percentage of FVC and MVV. From the study it was concluded that the incidence of pulmonary dysfunction (both obstructive and restrictive pattern) in female patients with RA and it must be pertinent to do Pulmonary Function Test to detect and monitor changes in lung function in subjects with Rheumatoid Arthritis.

Key words: Pulmonary function · Rheumatoid Arthritis · Maximum Voluntary Ventilation · Forced vital capacity

INTRODUCTION

Rheumatoid arthritis is a systemic disease manifested as a symmetric polyarthritis usually in the setting of elevated auto antibodies [Rheumatoid factor] [1]. This disease is the most common inflammatory arthritis affecting 0.5-2% of the world's population, most frequently in the 25-55 year old age group and has a female predominance (2.5:1). Nearly 50% of patients with Rheumatoid arthritis demonstrate some type of extra-articular manifestation of the disease [2].

Pulmonary involvement in Rheumatoid arthritis is seen in 30% of the cases and it could be due to the disease itself as well as to the therapies used to treat it. Lung disease is the second most common cause of death following infection. There are many forms of lung disease in Rheumatoid arthritis including interstitial fibrosis, bronchiolitis and small airway diseases [3,4].

Clinical symptoms of pulmonary insufficiency occur less frequently than the histological changes because RA imposes limitations that make physical exertion difficult, thus respiratory involvement may be asymptomatic. However, the mortality rate from pulmonary disease in RA is twice that of the general population [5]. In clinical practice pulmonary function testing is used most commonly to estimate prognosis, follow the course of the disease or the response to therapy, detect untoward reaction to drugs and to assess functional impairment or disability [6,7]. Thus the study was conducted to find the changes in the lung function parameters FVC and MVV of female subjects with Rheumatoid arthritis.

MATERIAL AND METHODS

100 female subjects with Rheumatoid arthritis in the age group of 20-60 years were selected from the Rheumatology OPD of Stanley Medical College and Hospital, Chennai. Ethical approval from Ethical committee, Stanley Medical College and Hospital, Chennai was obtained for the study. Written informed consent was taken from each subject after the detailed procedure and purpose of the study was explained to the subjects.

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The recordings were done usually between 10.00am to 1.00pm in the morning after light breakfast and in standing position without nose clips. All the techniques of measurement, duration and instruments were maintained uniformly throughout the study.

The following inclusion and exclusion criteria were applied for the selection process [8]

Step I

Inclusion Criteria

- 100 Rheumatoid arthritis female subjects participated for at least 6 weeks.
- Female subject age ranged between 20-60
- The subjects for the study were selected based on 1988 Revised American Rheumatism Association criteria.

Exclusion Criteria

- Subjects with respiratory illness
- Subjects with coronary artery disease
- Male subjects
- Smokers
- Subjects with thoracic abnormality
- Subjects with vertebral abnormality
- Subjects on Methotrexate

Step II: The present study was conducted in the Department of Physiology, Stanley Medical College, Chennai. The participants were made to relax and be comfortable prior to the tests. Detailed clinical history about Rheumatoid arthritis was collected. Physical and general examination-Normal standard height was measured without foot wear, with the subjects back to a wall and with both heels placed together and touching the floor. Weight was recorded without footwear and with empty pockets. General and systemic examinations pertaining to respiratory and cardiovascular system were done and findings were recorded. The pulse rate, Respiratory rate and Blood pressure were recorded in each subject under resting condition.

Step III: The Spiro lab is computerized pulmonary function testing equipment developed indigenously by *SDI DIAGNOSTICS PVT.LTD, ITALY*. Laboratory assessments were performed in "SPIROLAB II" and the generalized system of instrumentation performance were done during pulmonary function test which includes- Subject-Transducer-Signal processing and-Display. The following equipment and performance validations steps for SPIROLAB II were done before the study which includes equipment validation, equipment quality control measurements, procedure, acceptability and reproducibility [9].

Functional Parameters Studied

Forced Vital Capacity (FVC) in Liters [10]: It is the amount of air that can be expelled from the lung when exhalation starts at the maximal inspiratory level and proceeds to the maximal expiratory level. The Forced Vital Capacity (FVC) test was performed by having the patients inhale a Total Lung Capacity (TLC), with maximum forced exhalation into a Spirometer. Traditionally, exhaled volume was measured as a function to indicate the flow and also measured the function of exhaled volume.

Maximum Voluntary Ventilation (MVV) [10]: It is the largest volume of air that can be moved in and out of the lungs in one minute by voluntary effort.

RESULTS AND DISCUSSION

Pulmonary function test results were expressed as percentage of predicted values for each individuals adjusted for age, sex and height. The results were analyzed and following observations were received.

Table 1: Mean Values

Parameters	Mean	Std Deviation	Minimum	Maximum
Age	42.41	9.67	20	60
Weight	57.75	12.07	35	90
Height	154.19	6.43	141	170
Body Mass Index	24.25	4.74	15.06	36.79
Duration of disease	4.77	3.22	1	16

Table 2: Comparison of Duration of Disease with PFT Parameters

Parameters	Duration of disease	Number of subjects	Mean	Std. Deviation	ANOVA F-test	Bonferroni t-test
FVC% pred	< 2	30	71.40	12.36	F=9.99	5 Vs 1
	2-4	21	67.28	15.05	P=0.001	5 Vs 2
	4-6	23	65.85	11.09		5 Vs 3
	6-8	14	65.73	16.22		5 Vs 4
	>8	12	42.33	13.15		
	Total	100	64.47	15.61		
MVV%pred	< 2	30	68.47	15.622	F=0.67	
	2-4	21	74.43	14.566	P=0.62	-
	4-6	23	72.09	14.838		
	6-8	14	66.29	13.980		
	>8	12	69.25	28.204		
	Total	100	70.34	16.885		

Table 3: Comparison of Duration of Disease and Mean FVC % prediction

Duration of disease	N	Mean	Std. Deviation	ANOVA F-test	Bonferroni t-test
< 2	30	71.40	12.36	F=9.99	5 Vs 1
2-4	21	67.28	15.05	P=0.001	5 Vs 2
4-6	23	65.85	11.09		5 Vs 3
6-8	14	65.73	16.22		5 Vs 4
>8	12	42.33	13.15		
Total	100	64.47	15.61		

p-value = 0.001 highly significant

Table 4: Correlation Between Duration of Disease and FVC % Prediction

FVC%	r-value
Pearson Correlation	-.487(**)
Sig. (2-tailed)	.001
N	100

** Correlation is significant at the 0.01 level (2-tailed).

Interpretation for r-value

Pearson correlation coefficient is denoted by “r”

“r” always lies between-1 to +1

0.0-0.2 poor correlation

0.2-0.4 fair correlation

0.4-0.6 moderate correlation

0.6-0.8 substantial correlation

0.8-1.0 strong correlation

Table 5: Association Between Duration of Disease and FVC%prediction

	FVC%PRED			
	<80%		>80%	
Duration (yrs)	n	%	n	%
< 2	5	16.7%	25	83.3%
2-4	7	33.3%	14	66.7%
4-6	11	47.8%	12	52.2%
6-8	10	71.4%	4	28.6%
>8	18	67.7%	4	22.3%

$\chi 2$=16.92 P=0.002 significant

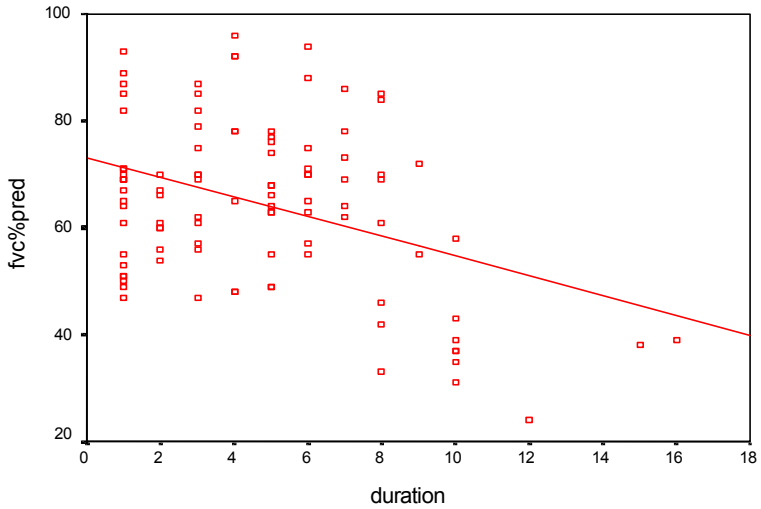

Fig. 1: Correlation Between Duration of Disease Fvc% of Prediction
Scatter Diagram shows the negative correlation relationship between duration of disease and FVC% of prediction

DISCUSSION

The current study was focused to find out the relation of pulmonary function in female with Rheumatoid arthritis (RA).The study was carried on 100 females with RA in the age group 20-60 years, who fulfill the Revised American Rheumatism Association Criteria, 1988. [11]. Patients with respiratory illness, smoking habits, treated with methotrexate were excluded from this study [12]. Patients were well examined with by height, weight, pulse rate, respiratory rate and blood pressure.

Forced vital capacity measure the change in lung position from maximal inspiration to maximal expiration considered a measure of the subject's ability to change the size of the thoracic cavity. This is influenced by all the muscles of respiration and their innervations by the thoracic cage, by lung elasticity and by the patency of the airways [13].

The results were analyzed using Anova-F test. By comparing the relationship between the duration of the disease and the mean predicted values showed an obstructive as well as a restrictive pattern as evidenced by a decrease in FVC. Scatter Diagram shows the negative correlation relationship between duration of disease and FVC% of prediction (Fig. 1). Similarly, Pearson's correlation co-efficient analysis was done to determine the relationship between the duration of the disease and pulmonary function changes which also revealed a negative correlation between the same.

According to Fuld JP and Johnson MK [14] "Asymptomatic patient with Rheumatoid Arthritis have a higher prevalence of PFT abnormalities than expected, but these do not increase in number over time." But in our study we found that there was a negative correlation between the duration of the disease and the percentage of prediction of FVC and MVV. The reduction may be due to bronchial wall thickening/ Interstitial Fibrosis/bronchial infection. Recent findings have suggested, repeated extraneous insult and exposures are considered to be responsible for recurrent alveolar injury, inflammation and dysregulated tissue repair and fibro proliferation resulting in pulmonary fibrosis [15, 16].

The present study concluded that there was an obstructive and restrictive pattern as evidenced by a decrease in FVC and MVV. These changes decreased with increase in the duration of disease. So, it is pertinent to do Pulmonary Function Test in order to detect and monitoring changes in lung function in subjects with Rheumatoid Arthritis.

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