

A Cross-Sectional Study of Pulmonary Function Test Patterns in Patients of Rheumatoid Arthritis Attending a Tertiary Care Hospital of Kolkata

Debanjali Chakrabarti¹, Chiranjit Bal², Kaushik Basu³

¹Post Graduate Trainee, Department Of Physiology, Medical College and Hospital, Kolkata

²Associate Professor, Department Of Physiology, Medical College and Hospital, Kolkata

³Assistant Professor, In-charge Rheumatology Unit, Department Of General Medicine, Medical College and Hospital, Kolkata

Abstract: Rheumatoid Arthritis (RA) is a chronic inflammatory disorder of unknown etiology characterized by symmetrical peripheral polyarthritis often resulting in joint damage and physical disability. Several extra-articular manifestations are also associated with RA out of which pleuro-pulmonary involvement is the most important as it bears clinical significance in terms of increased morbidity and mortality. While several earlier studies have declared Interstitial Lung Disease (ILD) to be the most serious form, there are emerging evidences of other forms of pulmonary involvement but lack of studies categorising them in eastern India. Pulmonary Function Tests (PFTs) are widely used to provide objective measure of lung function for detecting and quantifying such lung diseases. The primary aim of this work is therefore to find out the association of pulmonary diseases with RA depending on PFT parameters and to establish the usefulness of PFTs to diagnose such lung diseases even before the appearance of symptoms to aid early intervention.

50 RA cases and 50 healthy controls of either sex and age above 16 years were recruited for Pulmonary Function Tests. Data mining and statistical analysis revealed increased frequency of lung diseases in 76% of RA cases and significant difference in various PFT parameters as compared to normal healthy controls. 34% of cases had Restrictive lung disease, 4% had obstructive lung disease, 22% had small airway disease and rest 16% had mixed pulmonary disease. Thus PFT can be regarded as an effective diagnostic, prognostic and research tool to detect and categorize lung diseases associated with Rheumatoid Arthritis and ultimately guiding treatment protocols.

Key Words: Rheumatoid Arthritis, Pulmonary Function Tests, Obstructive Lung Disease, Restrictive Lung Disease, Small airway disease

Date of Submission: 26-12-2019

Date of Acceptance: 10-01-2020

I. Introduction:

RA affects around 0.5% to 1% of general population worldwide^[1] and 0.75% of the population in India^[2]. It can affect all ages but is frequently found in the age group of 25-55 years with a female to male ratio of 2.5:1^[3]. Extra-articular manifestations are frequently associated with RA, with an estimated prevalence of about 40%^[4]. Out of all the extra-articular manifestations, lung disease is a major contributor to morbidity and mortality^[5]. Different studies show lung involvement in RA cases ranging from 67% to as low as 10%^[6,7]. Pulmonary Function Tests (PFTs) are important non-invasive tests for preliminary diagnosis of underlying lung abnormalities in patients with RA. Different PFT parameters like Forced Vital Capacity (FVC), FEV1 (Forced Expired Volume in one second), FEV1/FVC ratio, FEF_{25-75%} (Forced Expiratory Flow between 25-75% of vital capacity), PEF (peak expiratory flow) and Maximum Voluntary Ventilation (MVV) can be used to categorize such lung diseases. This study aims to evaluate and characterize the PFT patterns in RA cases compared to normal controls and establish the usefulness of these tests to detect such lung diseases even before the appearance of symptoms and thus helping in early intervention.

II. Material And Methods:

A cross-sectional analytical study was conducted in Medical College and Hospital, Kolkata over a period of 1 year where pulmonary function abnormalities were studied in patients with rheumatoid arthritis and their lung function test findings compared with age and sex matched controls. 50 patients of either sex and in the age group 16 -70 years, attending the Rheumatology clinic of Medical College and Hospital, Kolkata and diagnosed as RA cases by the 2010 ACR/EULAR classification, with or without respiratory symptoms, were included as cases. Smokers and persons having other connective tissue or respiratory disorders were excluded.

50 healthy persons from general population without RA or other comorbid conditions and age and sex matched with those of cases were included as controls.

After taking informed consent and doing physical examination, pulmonary function tests were performed. Different PFT parameters like Forced Vital Capacity (FVC), Forced Expiratory Flow in the 1st second (FEV1), FEV1/FVC Ratio, Mid expiratory flow (FEF25-75%), Peak Expiratory Flow Rate (PEFR), Maximum Voluntary Ventilation (MVV) were recorded and interpreted. Gaussian testing by Kolmogorov Smirnov test showed normal distribution of data, so parametric testing protocol was used for this study. All inter-group (cases versus controls) data showed equal variance by F-test and hence comparison was done using Student's unpaired t-test with equal variance. p values < 0.05 considered to be statistically significant, with a confidence interval of 95%.

III. Results:

Table 1: Demographic Comparison Between Cases And Controls

| PARAMETERS | CASES (n =50) (Mean + SD) | CONTROLS (n = 50) (Mean + SD) | p value |
|------------------|-----------------------------------|---------------------------------------|---------|
| AGE (in years) | 43.82 + 11.09 | 41.16 + 10.79 | 0.22 |
| WEIGHT (in Kg) | 54.7 + 11.24 | 58.24 + 9.49 | 0.06 |
| HEIGHT (in cm) | 153.18 + 6.9 | 155.7 + 6.61 | 0.09 |

p > 0.05 → not significant

Fig 1:

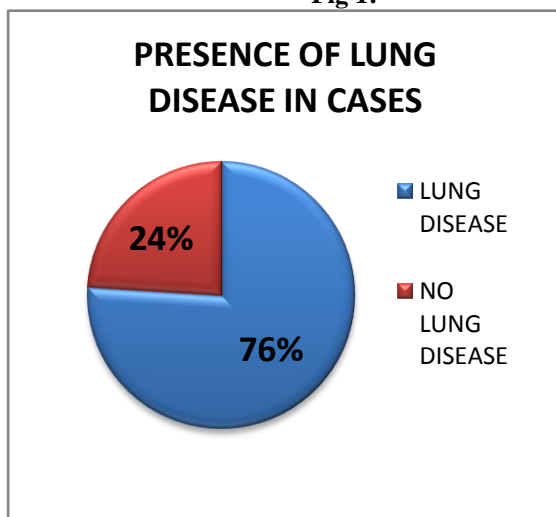


Fig 2:

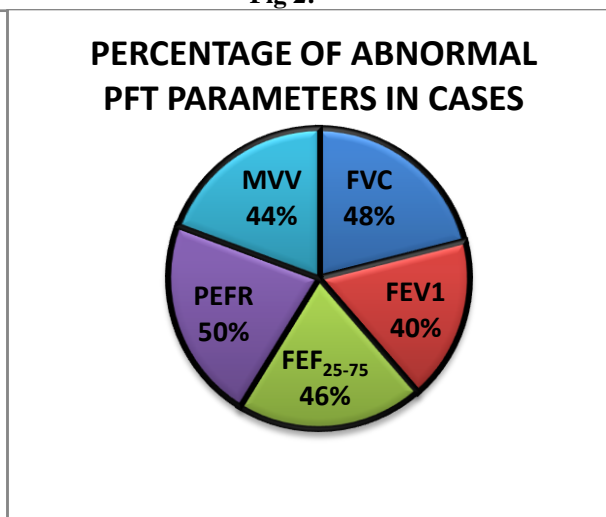


Table 2 : Comparison Of PFT Parameters Between Cases And Controls

| PARAMETERS | CASES (n= 50) (Mean + SD) | CONTROLS (n = 50) (Mean + SD) | p value |
|---------------------------|-----------------------------------|---------------------------------------|---------------|
| FVC (%) | 79.98 + 21.45 | 89.46 + 17.17 | 0.016* |
| FEV ₁ (%) | 86.86 + 22.02 | 96.02 + 18.14 | 0.026* |
| FEV ₁ /FVC (%) | 110.18 + 16.27 | 108.32 + 18.02 | 0.589 |
| FEF _{25-75%} (%) | 77.64 + 30.26 | 96.56 + 20.97 | 0.000* |
| PEFR (L/min) | 292.884 + 108.03 | 402.06 + 106.95 | 0.000* |
| MVV(V) | 76.24 + 20.72 | 99.04 + 25.62 | 0.000* |

*p value < 0.05 → significant, p value > 0.05 → not significant

Table 3: Risk Estimate Of Lung Diseases With RA

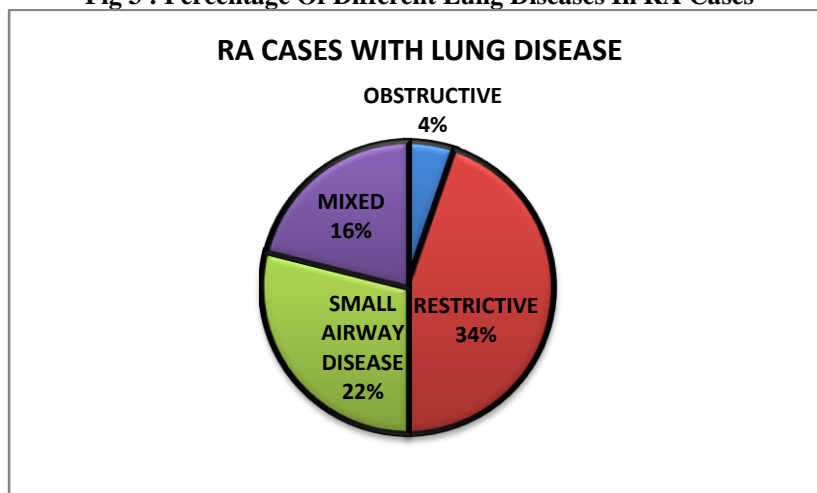
RA (Yes=1/No =0) * LUNG DISEASE(Yes=1,No=0) Crosstabulation

| Count | LUNG DISEASE(1=Y,0=N) | | Total |
|---------------|-----------------------|----|-------|
| | 0 | 1 | |
| RA (Y=1/N =0) | 0 | 35 | 15 |
| | 1 | 12 | 38 |
| Total | | 47 | 53 |
| | | | 100 |

| | Risk Estimate | | |
|--------------------------------------|---------------|-------------------------|--------|
| | Value | 95% Confidence Interval | |
| | | Lower | Upper |
| Odds Ratio for RA (Y=1/N=0) (0 / 1) | 7.389 | 3.043 | 17.942 |
| For cohort LUNG DISEASE(1=Y,0=N) = 0 | 2.917 | 1.724 | 4.933 |
| For cohort LUNG DISEASE(1=Y,0=N) = 1 | .395 | .251 | .620 |
| N of Valid Cases | 100 | | |

Odds Ratio (OR) >1 indicates increased frequency of lung diseases among RA patients

Fig 3 : Percentage Of Different Lung Diseases In RA Cases



IV. Discussion:

Pulmonary Function Tests (PFTs) are non-invasive and cost-effective tests to measure lung volumes and air flow rates and can be effective screening tools for the diagnosis of lung diseases associated with RA even before the appearance of symptoms.

Among the 50 RA cases included in our study, 44 were females and 6 were males with a mean age of 43.82 years (SD 11.09 years, range 16-70 years) showing a high female to male ratio of 7:1, mean duration of disease 5.1 years (SD 4.79 years, range 6 months - 20 years). Maximum number of cases were in the age group of 26-55 years. Out of 50 healthy controls, 40 were females and 10 were males with a mean age of 41.16 years (SD 10.79 years, range 16-70 years).

Bilgiciet al. in a study in 2003 found lung abnormalities in 67% cases of RA using High Resolution Computed Tomography (HRCT) thorax and PFT [8]. **S.Madhavan et al.** in an Indian study found 36.6% pulmonary function abnormalities in RA patients, with small airway disease observed in 20% of cases, restrictive lung disease in 10% of patients and large airway disease in 6.6% of patients [9].

In our study, 38 out of 50 RA cases (76%) had evidence of lung disease on the basis of abnormal PFT parameters though none of them presented with any respiratory symptoms. Abnormal FVC (%), FEV1 (%), FEF25-75% (%), PEFR (L/min) and MVV (V) were recorded in 24(48%), 20(40%), 23(46%), 25(50%) and 22(44%) RA cases respectively. The PFT parameters in cases like FVC, FEV1, FEF25-75%, PEFR and MVV were significantly reduced ($p < 0.05$) as compared to those of controls, except FEV1/FVC. Odd's Ratio > 1 suggested an increased frequency of lung diseases in RA cases.

Nazish Fatima et al. have found PFT abnormalities in 43% of RA cases, out of which 29% had restrictive pattern, 8% had obstructive pattern and 6.4% had mixed pattern [10]. **Rajan SK et al.** observed that out of 42.5% cases with PFT abnormalities, small airway disease was seen in 20%, large airway disease seen in 7.5% of patients and restrictive pulmonary disorder seen in 15% of patients [11]. **Radouxet al.** found that small airway obstruction is seen in 50% of cases with decrease in FEF 25-75% [12].

The present study showed similar findings. Out of 38 (76%) RA cases with PFT abnormalities, 17 (34%) showed restrictive pattern of disease, 2 (4%) showed obstructive pattern, 11 (22%) showed small airway disease and 8 (16%) had mixed pattern of disease.

Though none of the 50 RA cases presented with any respiratory symptoms, 76% of them were having underlying PFT abnormalities. But, HRCT-thorax, that can confirm the actual diagnosis of lung disease in these patients, could not be done because of patient non-compliance and non-availability of DLCO.

V. Conclusion:

Thus, from our study we can see that Rheumatoid Arthritis patients can have associated lung diseases with or without the evidence of respiratory symptoms. RA is more prevalent in the age group of 26-55 years with a female preponderance and lung abnormalities are also more prevalent in this age-group. PFT parameters, namely FVC (%), FEV1 (%), FEF25-75% (%), PEFR (L/min) and MVV (V) are significantly reduced in cases compared to normal controls. There is increased risk of lung diseases in RA cases. Most common ventilatory defect identified by PFT is restrictive disease followed by small airway disease, mixed pattern and ultimately obstructive disease. Thus, Pulmonary Function Tests can be used as an early diagnostic tool to not only detect any pulmonary dysfunction in RA patients but also categorise such lung diseases even before the appearance of symptoms and help in early management.

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Debanjali Chakrabarti et al. "A Cross-Sectional Study of Pulmonary Function Test Patterns in Patients of Rheumatoid Arthritis Attending a Tertiary Care Hospital of Kolkata." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(1), 2020, pp. 35-38.