

## ASSESSMENT OF PULMONARY FUNCTION TEST BY SPIROMETRY IN PATIENTS OF RHEUMATOID ARTHRITIS

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### Abstract

**Background:** Rheumatoid arthritis is a persistent, inflammatory, systemic illness mainly affecting multiple joints. Rheumatoid arthritis affects 0.8% of people worldwide, ranging from 0.3% to 2.1%. Pulmonary involvement is also evident in rheumatoid arthritis, which includes pulmonary nodules, diffuse interstitial pulmonary fibrosis, exudative pleural disease, and interstitial lung disease. To assess the lung function of patients with rheumatoid arthritis, A spirometry test tracks a subject's breathing patterns by measuring the amount of air they inhale and expel over time. A study was proposed to estimate spirometry indices in patients with rheumatoid arthritis.

**Material & Methods:** Patients diagnosed with rheumatoid arthritis (RA) were the subjects of this cross-sectional, observational study who visited the Rheumatology clinic at the General Medicine Department at the National Institute of Medical Sciences and Research, Jaipur. All the participants underwent a pulmonary function test using the EasyOne Pro computerized spirometer, and their lung indices were recorded in a predesigned form. After gathering and entering the data into Microsoft Excel, SPSS version 23 was used for statistical analysis. The categorical data was presented as tables with numbers and percentages, whereas medians and interquartile ranges, or means and standard deviations, were used to summarize continuous variables.

**Results:** In our study, eighty-five rheumatoid arthritis patients were included, most of whom were above fifty years and  $54.25 \pm 1.2$  years as the mean age. Female patients were dominant (64.7%). They identified significant airway obstruction in 20%, small airway disease in 12%, and restrictive lung disease in 39% of patients.

**Conclusion:** According to this study, respiratory symptoms and pulmonary function tests are essential for assessing individuals with rheumatoid arthritis, and early intervention strategies must be employed to provide better care.

**Keywords:** Pulmonary Function Test (PFT); Spirometry, Rheumatoid Arthritis (RA), Lung Capacity

## 1. BACKGROUND

Rheumatoid arthritis is a multi-joint autoimmune disease that is persistent and has no recognized cause. Its defining features are symmetric peripheral polyarthritis and systemic involvement [1,2]

Pulmonary involvement seen in 30% of cases is primarily asymptomatic. Because these patients are physically less active due to chronic pain and fatigue, they are less likely to develop breathlessness.[3] Pulmonary involvement is a significant contributor to the rates of morbidity and mortality among rheumatoid arthritis patients, which is the second most common cause of death in this population. [4] Rheumatoid arthritis affects 0.8% of people worldwide, ranging from 0.3% to 2.1%. Like other autoimmune disorders, rheumatoid arthritis affects women more frequently than men, with approximately three times higher rates among females.

Clinical Features of Rheumatoid Arthritis:

- Individuals with rheumatoid arthritis typically experience the following joint symptoms:
- Common symptoms include joint pain and stiffness, with the metatarsophalangeal joint, metacarpophalangeal joint, and cervical spine being the most commonly affected areas.
- morning stiffness lasting more than one hour could indicate inflammation.
- The boggy swelling present in the affected joint is caused by synovitis.
- On palpation, synovial thickening is seen.
- One of the main symptoms of temporomandibular joint ankylosis is difficulty opening the mouth.
- Rheumatoid arthritis-related pulmonary involvement can lead to interstitial lung disease, diffuse interstitial pulmonary fibrosis, pulmonary nodules, and exudative pleural illness.

Pleurisy, parenchymal nodules, interstitial lung disease, airway disease, pulmonary fibrosis, bronchiolitis, and bronchiectasis are a few examples of rheumatoid arthritis's pulmonary symptoms.[3] Studies have shown that interstitial lung disease and alveolitis are found in 40% of rheumatoid arthritis patients with elevated rheumatoid factor titer levels. These symptoms can lead to respiratory failure. [5,6]

Spirometry is a non-invasive physiological test to assess lung function by measuring an individual's air volume over time. There is a lack of information regarding lung function in RA patients. To fill this gap, a study has been proposed to estimate spirometry indices in Rheumatoid Arthritis patients in Jaipur, Rajasthan.

## 2. MATERIAL & METHODS

The cross-sectional observational study was conducted from July 1, 2022, to May 31, 2023, among patients diagnosed with Rheumatoid arthritis (RA) who visited the Rheumatology Clinic- General Medicine Department, National Institute of Medical Sciences and Research, Jaipur.

**Inclusion criteria:**

- Age range: 18 to 65 years old, either male or female.
- Diagnosed cases of Rheumatoid arthritis patients (ARA criteria).
- Patient who has given consent to participate in the study.

**Exclusion criteria:**

- Individuals who exhibit clinical signs of long-term respiratory conditions, such as bronchial Asthma, COPD, or tuberculosis.
- Patients with proven cardiac problems who had a history of smoking, Asthma
- Spirometry contraindications.

**Methodology:**

Eighty-five subjects were randomly selected, and written informed consent was obtained. Baseline data, utilizing a pre-made proforma, information about age, sex, time since disease onset, smoking status, and systemic and pulmonary symptoms were noted.

All participants were subjected to a pulmonary function test by EasyOne Pro computerized spirometer, and lung indices were recorded in predesigned proforma.

Pulmonary function assessments:

The patients were asked to sit calmly in the chair while the spirette was placed in their mouth with their lips sealed around it. They were then instructed to take slow and steady breaths, careful not to block or bite the spirette. During the test, the participant had to exhale entirely and inhale as hard and fast as possible. The best result was seen when the test was conducted two or three times.

Measurements were made of lung indices, including forced expiratory volume in the first second (FEV1), total lung capacity (TLC), forced vital capacity (FVC), and residual volume (RV) and recorded in a predefined format.

Statistical Analysis:

The Microsoft Excel program was used to enter all baseline and lung index data concurrently. Software for statistical analysis, SPSS version 23, was used. Categorical data was expressed as tables and summarized as numbers and percentages. The summaries of continuous variables were expressed as means and standard deviations or as medians and interquartile ranges.

### 3. RESULTS

In our study, eighty-five rheumatoid arthritis patients were included, most of whom were above fifty years and had a  $54.25 \pm 1.2$  year mean age. Female patients were dominant, 55/85 (64.7%). The illness persisted for 12 years on average. Smoking was reported in 8% of patients. Additionally, 18% of patients had diabetes, 22% had hypertension, and 5% had cardiovascular diseases. According to the drug use history, 80% of patients were taking NSAIDs, 76.5% were taking corticosteroids, 56% were taking methotrexate, and 44% were taking other drugs.

**Table 1 Study participants' demographic characteristics. (n=85)**

| CHARACTERISTICS    | SUB GROUP       | FREQUENCY | PERCENTAGE |
|--------------------|-----------------|-----------|------------|
| <b>Gender</b>      | Male            | 30        | 35.3%      |
|                    | Female          | 55        | 64.7%      |
| <b>Age</b>         | 18-30 years     | 14        | 16.5%      |
|                    | 31-40 years     | 17        | 20.0%      |
|                    | 40-50 years     | 19        | 22.3%      |
|                    | 50-65 years     | 35        | 41.2%      |
| <b>Drugs use</b>   | NSAIDS          | 68        | 80%        |
|                    | Corticosteroids | 65        | 76.5%      |
|                    | Methotrexate    | 48        | 56.5%      |
|                    | Others          | 38        | 44.7%      |
| <b>Comorbidity</b> | Diabetes        | 16        | 18.8%      |
|                    | Hypertension    | 19        | 22.3%      |
|                    | CVS             | 5         | 5.8%       |

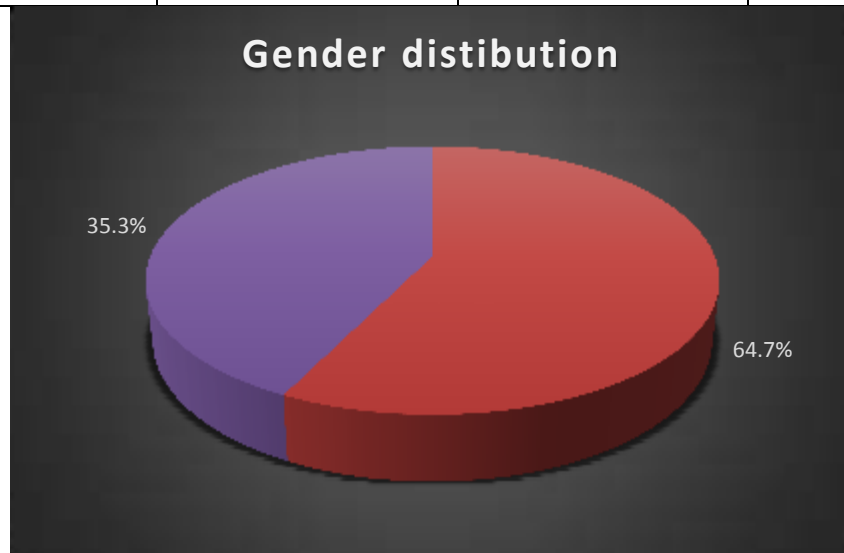


Figure 1: Distribution of gender among study subjects

**Table 2. Pulmonary characteristics of the study subjects (n=85)**

| CHARACTERISTICS     | SUB GROUP | FREQUENCY      |
|---------------------|-----------|----------------|
| <b>Spirometry</b>   | FVC       | 91.48+/-16.48  |
|                     | FEV1      | 61.93+/-16.7   |
| <b>FEV1/FVC (%)</b> | <70%      | 20%            |
|                     | 70-85%    | 41.2%          |
|                     | >85%      | 38.8%          |
| <b>Lung Volume</b>  | TLC       | 93.75+/-16.13  |
|                     | VC        | 93.85+/-17.42  |
|                     | RV        | 100.45+/-34.38 |

The patients under study were categorized into three groups based on their FEV1/FVC ratio. In the pulmonary function test, patients with FEV1/FVC below 70% were classified as having an obstructive pattern, while FEV1/FVC values between 70% and 85% were regarded as standard. Patients were diagnosed with restrictive lung disease if their FEV1/FVC ratio was more than 85%. According to the findings, 20% of the patients had an obstructive pattern. A restrictive pattern was seen in 39%, while minor airway illness was seen in 12%. More details are in [Table 2] [ Figure 2].

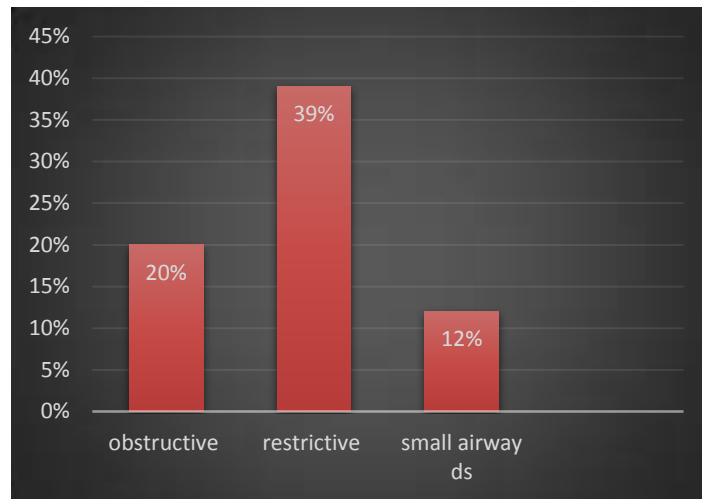


Figure 2: Spirometry findings among study subjects

#### 4. DISCUSSION

In this study, 85 patients with rheumatoid arthritis were included. In 39% of rheumatoid arthritis patients with FEV1/FVC >70% and decreased vital capacity and total lung capacity, a restrictive ventilatory defect was noted. A FEV1/FVC ratio of less than 80% indicates that 20% of individuals with rheumatoid arthritis have an obstructive ventilatory problem., accompanied by an increase in residual volume and total lung capacity ratio. We discovered that chest X-rays and spirometry frequently identify lung abnormalities in patients with RA, suggesting that these inexpensive screening methods need to be standard procedures. Morrison et al. evaluated 104 individuals with RA using chest X-rays and PFTs; of them, 53.8% had abnormalities, mostly from pleural illness (30%) and tuberculosis (44%). [7]

Malaviya et al. [8] conducted a study on North Indian RA patients, finding that 8% had pulmonary dysfunction. Eli Gabby et al. [9] discovered that the male gender is the only substantial risk factor for the onset of ILD in RA patients.

Numerous investigations have looked into rheumatoid arthritis patients' early lung involvement, but more attention needs to be given to the extent of lung involvement. [10,11]

When smoking or concurrent lung disease-related patients were eliminated, 19.2% of the patients were still abnormal, according to the study. The median survival time for rheumatoid arthritis (RA) patients is 9.9 years. However, RA patients with pulmonary conditions have a standardized mortality ratio of 2.86, which is higher than patients with RA alone. Most respiratory symptoms appear during the first five years of the illness. [12,13]

Our study aligns with previous research that found that pulmonary function tests (PFTs) indicate a restrictive defect in rheumatoid arthritis (RA) patients. precisely, the forced vital capacity (FVC) and total lung capacity (TLC) of these individuals are low. Other possible symptoms include Hypoxemia and limited lung diffusion capacity for carbon monoxide (DLCO). [14,15]

A sample of patients receiving treatment at a tertiary care referral centre's rheumatology clinic served as the basis for this cross-sectional study, which limits generalizability to other populations. It is possible that the individual had an illness that was more advanced or difficult to treat have comprised the enrolled patients, indicating a bias in the screening process. Furthermore, although the prevalence of crackles has been assessed earlier as a marker for RA-associated ILD, we did not consider this. [16]

## 5. CONCLUSION

This study concluded that patients were primarily female and that this was typical of smokers. A pulmonary function test is essential for patients with rheumatoid arthritis and is suggested in early intervention measures to improve outcomes. Assessment of pulmonary function and respiratory symptoms is usually necessary when evaluating patients with rheumatoid arthritis.

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