

## ORIGINAL PAPER

# Pulmonary Involvement of Rheumatoid Arthritis with Special Reference to HRCT Thorax and Spirometry

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## ABSTRACT

**Objective:** This study tries to evaluate the extent of pulmonary involvement of Rheumatoid Arthritis (RA) with the help of High-Resolution Computerized Tomography of Thorax and Spirometer. Thus, this study gives insight about necessity of ruling out pulmonary involvement in patients of Rheumatoid Arthritis early in the phase of treatment to cut-down both morbidity and mortality of such patients by offering them requisite treatment as early intervention. **Methods:** The study was conducted in the department of Medicine; Gauhati Medical College & Hospital over 40 cases of RA were diagnosed by the revised criteria for classification of Rheumatoid Arthritis (ACR-ULAR-2010 Criteria). The cases were thoroughly studied using a proforma to collect socio-demographic and clinical data. The clinical data collected on the ACR guidelines and laboratory parameter evaluation was also carried out. X-ray of any other joint involved, chest x-ray, ECG, High Resolution Computer Tomography (HRCT) Thorax and spirometer were collected. **Result:** More than half (n=21, 52.5%) of the sample had different abnormal lung parenchymal changes on HRCT and half of the sample had abnormal restrictive and mixed pattern in spirometer (n=20, 50%), showing very high prevalence of pulmonary involvement in patients of RA. **Conclusion:** There is definite relationship of pulmonary involvement in cases of RA, wherein HRCT proves to be more sensitive in detecting abnormalities that were clinically silent and missed on plain radiography. Good correlation between HRCT and spirometer exists and this contributes to detection of early parenchymal changes.

**Keywords:** Reticulonodular Pattern, Parenchymal Change, Inflammatory Changes

## INTRODUCTION

Rheumatoid Arthritis is a chronic multi-system disease characterized by persistent inflammatory response usually involving peripheral joints in a symmetrical distribution with a variety of extra-articular manifestations.<sup>1</sup> Pulmonary involvement is one of the most frequent manifestations amongst the systemic manifestations and these may even precede the development of arthritis by number of years.

Approximately 1% of the world's total population is affected by Rheumatoid Arthritis.<sup>2</sup> Women are affected approximately 3 times more often than men.<sup>2</sup> The prevalence of Rheumatoid Arthritis increases with age and the sex difference diminishes in older age groups. The onset is most frequent during the 4<sup>th</sup> and 5<sup>th</sup> decades of life, with 80% of the patients developing the disease between the ages of 35 to 50 yrs.

Rheumatoid Arthritis in Indian population is comparable to the world scenario, although the disease onset is relatively earlier and extra-articular manifestations are seen less frequently than those of the West.<sup>3</sup> The disease course is somewhat benign in the Indian patients.<sup>3</sup>

Pulmonary involvement is frequent in Rheumatoid Arthritis and occurs in a variety of forms<sup>4</sup> the commonest are pleural effusion, parenchymal nodules and interstitial fibrosis. Combinations of these manifestations are frequently seen. Other pulmonary

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manifestations of Rheumatoid Arthritis include- bronchiolitis obliterans, amyloidosis and vasculitis. These extra-articular manifestations occur because of aberrant immunological response resulting in end-organ damage.<sup>1</sup>

Pulmonary involvement results in significantly increased morbidity and mortality wherein dysfunctions may be either a direct effect of the underlying disease process or a secondary complication due to treatment toxicities and opportunistic infections.<sup>1</sup>

Most clinical trials on Rheumatoid Arthritis have focused on the constitutional and articular features and symptoms and have overlooked the extra- articular manifestations like the pulmonary manifestations, which become the cause of mortality in later part of the disease.

In its description by Scott D<sup>4</sup>, interstitial lung disease (ILD) quietly appeared as the predominant pulmonary manifestation of Rheumatoid arthritis after excluding drug-induced pulmonary disease. The appearance of pleuritic pain, shortness of breath, (either progressive or of recent onset) or hemoptysis suggests pulmonary disease in RA patients. Lung complications may include pleural disease, rheumatoid nodules, interstitial fibrosis, or Bronchiolitis Obliterans with Organizing Pneumonia (BOOP). Initial radio graphical studies found a lower incidence of 1.6-5% of ILD in Rheumatoid Arthritis. The incidence of pleuritis in RA patients is nearly 20%.<sup>5</sup> Diffuse interstitial fibrosis affects 10% of patients with RA.<sup>5</sup> Its clinical presentation is no different from the idiopathic pulmonary fibrosis, and it presents as a slowly progressing shortness of breath.<sup>6</sup> Coexisting subcutaneous rheumatoid nodules, high titres of circulating rheumatoid factor or antinuclear antibodies are also considered significant risk factors<sup>7</sup> while the incidence of ILD appears unrelated to the severity of articular disease.

HRCT is much more sensitive than plain chest radiography in the assessment of ILD and its higher sensitivity should help an earlier diagnosis. HRCT shows similar lesions, including ground glass opacification, basal honeycombing, traction bronchiectasis and emphysema.<sup>10</sup> HRCT was able to detect interstitial pneumonitis in Rheumatoid Arthritis patients with normal chest radiography. HRCT should, therefore, be performed in all Rheumatoid Arthritis patients presenting with either risk factors for ILD or minor changes on chest radiographs. Computed Tomography, particularly High Resolution thin section Computed Tomography(HRCT) is useful in differentiating and sensitively diagnosing interstitial processes, the detection of diseases in its early stage when radiographic changes are minimal or normal, and to determine the site and extent of the disease.<sup>8</sup>

Corlet B<sup>9</sup>, found that the most common HRCT finding was bronchiectasis (30.5%) followed by pulmonary nodule (28%) and air trapping (25%). Ground Glass Opacity (90%) and Reticulation (98%) were the most common CT features.<sup>10</sup>

Functional impairment, as assessed by spirometry concluded significant correlation with HRCT findings.<sup>11</sup> Similarly Cortet B<sup>9</sup>, found that there is significant association between small airway involvement on PFT and bronchiectasis on HRCT in unselected Rheumatoid Arthritis patients. The forced expiratory

flow rate between 25% and 75% of the vital capacity (FEF 25-75%) was more reduced in patients with interlobular septal thickenings than in patients without these thickenings. The patients with mosaic attenuation had significantly lower mean values of FEF (25-75%) and a lower peak expiratory flow than patients without mosaic attenuation. It is widely known that a relatively higher percentage of mosaic attenuation with air-trapping and a good correlation between these and functional values contribute to the detection of early airway obstruction with Rheumatoid Arthritis, and even in patients with infiltrative lung disease only.<sup>12</sup>

## MATERIALS AND METHODS

The study was conducted in the department of Medicine; Gauhati Medical College & Hospital. A total of 40 cases of RA were diagnosed by the revised criteria for classification of Rheumatoid Arthritis (ACR-ULAR2010) Criteria.<sup>13</sup> The cases were thoroughly studied using a proforma to collect socio-demographic and clinical data. The Clinical data collected on the ACR guidelines and laboratory parameter evaluation was also carried out. X-ray of any other joint involved, chest x-ray, ECG, HRCT Thorax and spirometry were collected including routine blood parameters Rheumatoid Factor, ANA, S. Uric Acid, ASO Titre and C - reactive protein. Reports of informed consent were taken from each patient to include in the study. Ethical clearance was obtained from the institutional ethical committee of GMCH.

**Objectives:** To assess the incidence of lung involvement in Rheumatoid Arthritis in relation to CT Thorax and Spirometry findings.

## RESULTS

The clinical presentations of the disease as well as incidence of pulmonary manifestations were observed and analyzed in 26(65%) females and 14 male (35%). The male to female ratio was 7:13. The house-wives formed the majority group and the lower-income group had the highest incidence of Rheumatoid Arthritis (37.5%). Only 5% of the cases have first degree relatives being affected. Presenting symptoms were analyzed and the most common symptom was found to be polyarthritis (95%) followed by morning stiffness (62.5%) and difficulty in doing house-hold jobs (25%). The most common constitutional symptom is morning stiffness. The maximum number of cases had duration between 6 months to 1 year (37.5%). Majority of patients had insidious onset of illness (97.5%). Metatarsophalangeal joints were found to be affected highest in our sample (100%) followed by proximal inter-phalangeal (PIP) joints (92.5%) and wrist joints (85%). More than one joint were involved in the same patient. 17.5% of the sample had pulmonary involvement in the form of cough followed by 10% with respiratory difficulty, but 72.5% of patients did not have any pulmonary involvement. The radiological joint changes were graded and maximum number of patients had grade I (Peri-articular osteoporosis) radiological progression(50%) followed by grade III (Erosion) in 27.5% patients. 22.5% of the patients did not have any changes. PA View of chest was done to see presence of any cardio-pulmonary changes. Following tables shows the various findings of this study.

**Table 1** Findings of chest x-rays

Chest X-RAY	No. of cases	Percentage
Normal	30	30
Non-specific increased broncho-pulmonary vascular markings	2	2
Cardiomegaly	1	1
Non-homogeneous opacity	1	1
Bronchiectasis	2	2
Pleural effusion	3	3
Pneumonitis with consolidation	2	2

The patients underwent High-Resolution thin sliced Computed Tomography of thorax and most of the CT was normal as shown in **Table 2**. HRCT Scan of thorax was normal in most of the patients (47.5%).

**Table 2** Findings on HRCT Thorax

CT Scan(HRCT)	No of cases	Percentage
Normal	19	47.5%
Reticulonodular pattern	4	10%
Interstitial pneumonia	2	5%
Fibrosis including interlobular thickening	3	7.5%
Bronchiectasis	7	17.5%
Pleural effusion	3	7.5%
Pleural thickening	2	5%

All 40 patients included in the study under-went spirometry and data were obtained from a forced expiratory maneuver and these were used to generate (volume vs. time) curve, (flow vs. volume) of curves. Both types of curves gave the same information; the flow volume type of curve is helpful in detecting inadequate patient's effort. Assessment done was broadly classified into restrictive, obstructive and mixed pattern. **Table 3** shows the various patterns of findings.

**Table 3** Findings on Spirometry

Spirometry	No. of cases	Percentage
Normal	20	50%
Restrictive	19	47.5%
i)Mild	10	25%
ii) Moderate	5	12.5%
iii) Moderate-severe	2	5%
iv) Severe	2	5%
Mixed pattern	1	2.5%

## DISCUSSION

Rheumatoid Arthritis is a common disorder; affecting people of all ethnic group worldwide. Prevalence in general population is 0.5%-1%<sup>14</sup> although Rheumatoid Arthritis can occur at any age, the incidence increases with advancing age. The peak incidence of RA occurs during 4<sup>th</sup> to 5<sup>th</sup> decade of life. Ankoor Shah<sup>14</sup> found it to have increases between 25 to 55 years of age and plateaus at 75 and then decreases which has the similarity with our study. Females are affected more commonly than males in the ratio of 2-3:1<sup>14</sup> similar to our study (1.8:1).

Most of our patients had an insidious onset (97.5%) reflecting the usual onset of the illness and the most common presenting symptom was polyarthritis, MCP joints being the most commonly affected (100%), followed by PIP joints in 37 cases (92.5%) and the wrist joint in 34 cases (85%). Akhil M<sup>15</sup> found wrist joints to be most commonly affected, as are the PIP and MCP joints. Morning stiffness was the commonest complaint in 62.5% with other constitutional symptoms in 22.5% cases.

Thoracic involvement often develops in patients as their disease progresses. Pleural disease is the most common thoracic manifestation and is seen much more frequently in men.<sup>14</sup> Pleural effusions is the most common respiratory manifestation and are usually unilateral and may be loculated. They usually occur late in the disease and are commonly associated with pericarditis and subcutaneous nodules. Habib HM<sup>16</sup> described pulmonary involvement with pericardial effusion (21%), pleural effusion (9%) and pulmonary fibrosis (6%). In our study (7.5%) presented with pleural effusion which was unilateral, bilateral and encysted effusion respectively supportive of study done by Koshy S<sup>17</sup> (3.6%). Pleural thickening is the next most common finding and is seen more often than pleural effusion.

HRCT done in all the 40 cases revealed all the finding described by various authors mentioned in the various studies. A spirometric finding of RA patients has shown in **Table 3**. Kelly CA<sup>18</sup> described restrictive changes in PFT studies. Terasaki H<sup>11</sup> described significant functional impairment in spirometric parameters mainly the FEF 25-75. Raghu G<sup>19</sup> was of opinion that restrictive impairment of respiratory function was the general finding in definite rheumatoid arthritis patients. Geddes DM<sup>20</sup> studying airway obstruction in rheumatoid arthritis patients opined that the prevalence is high and suggested that airway diseases may be the commonest form of lung involvement. Gabbay E<sup>21</sup>, found normal spirometric values in 2/3<sup>rd</sup> of 100 patients (>33%) reduced lung capacity in 3% - 6%; finally came to the conclusion whether significant restriction of ventilation is present in chronic poly arthritis.

Linstow M<sup>22</sup> states that pulmonary function is unrelated to patient's age, duration, disease activity and in fact improves in course of time, despite a slight decrease in vital capacity and continued articular activity. Koshy S<sup>17</sup> showed a restrictive pattern in 20.8%, obstructive pattern in 7% and mixed pattern in 5.5% persons.

Saracoglu M<sup>23</sup> described HRCT appearances as the most appropriate tool for detection and follow-up of ILD associated with Rheumatoid Arthritis. The spirometry co-relate only partially

with grading of HRCT, however they contribute valuable information about dynamic lung function and differential diagnosis.

The serological marker Rheumatoid Factor (RF) plays a significant role in disease pathology and its outcome, though not specific for Rheumatoid Arthritis. In present study, RF positive (90%) and titre in the range of 40iu/ml were highest and replicated with findings of study by Margo CM<sup>24</sup> and Habib H M.<sup>16</sup> Anaemia as a common hematological disturbance was replicated by Ankoor<sup>14</sup> in this study too.

## CONCLUSION

The study reveals that pulmonary involvement is a common finding in Rheumatoid Arthritis. HRCT is the most appropriate tool for detection and follow-up of ILD associated with Rheumatoid Arthritis. There is significant association between small airway involvement on PFT and bronchiectasis on HRCT amongst the Rheumatoid Arthritis patients. The spirometry correlates with HRCT findings and will contribute valuable information about dynamic lung function. Good correlation between HRCT and spirometer exists and this contributes to detection of early parenchymal changes in the lung.

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