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RESEARCH ARTICLE

Evaluation of lung function tests in rheumatoid arthritis patients

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ABSTRACT

Background: Pulmonary manifestation is one of the most common extra-articular features in rheumatoid arthritis (RA) leading to significant morbidity. Lung function testing helps in identifying the type of respiratory defect. Early detection helps in effective management of the lung involvement in RA. **Aims and Objectives:** In this study, we compared the lung function of RA patient with the normal controls. **Materials and Methods:** Spirometry was performed in 100 participants (50 RA patients and 50 normal controls). Lung parameters such as forced vital capacity, forced expiratory volume in 1 s, forced expiratory flow in 25-75%, and peak expiratory flow rate were measured. Statistical analysis was performed, $P < 0.05$ was considered statistically significant. **Result:** In this study, restrictive ventilatory defect was seen in 64% of patients, and obstructive ventilatory defect was seen in 10% of patients. Pulmonary function abnormalities are common in asymptomatic rheumatoid patients which were found to be restrictive defect. **Conclusion:** Restrictive ventilatory defect may be due to idiopathic pulmonary fibrosis characterized by high levels of rheumatoid factor, antinuclear antibody and deposits of immunoglobulin A, and complement on the alveolar wall. Screening of RA patients with spirometer helps in early detection of pulmonary involvement.

KEY WORDS: Rheumatoid Arthritis; Restrictive Defect; Spirometer

INTRODUCTION

Rheumatoid arthritis (RA) is a chronic inflammatory autoimmune disease of unknown etiology. It is characterized by symmetrical peripheral polyarthritis[1] associated with systemic involvement. There is an increase in rheumatoid factor level. It affects nearly 1% of population.[2] The participants with HLAD4 and HLADR4 are prone to develop RA. The female to male ratio is 3:1.[2] The incidence increases between 25 and 55 years of age reaching a plateau till the age of 75 years and decreases. Risk factors such as genetic factors, infectious agent, oral contraceptive pills, and smoking play a role in etiology. Extra-articular manifestations are more common. Pulmonary involvement seen in 30% of cases is mostly asymptomatic. It is because these patients are physically less active due to chronic pain and fatigue so less likely to develop breathlessness.[3] Pulmonary involvement contributes to morbidity and mortality in rheumatoid patients. It is the second common cause of death.[4] Pulmonary manifestations may be pleurisy, parenchymal nodule, interstitial lung disease, airway disease, pulmonary fibrosis, bronchiolitis, and bronchiectasis.[3] Interstitial lung disease and alveolitis are seen in 40% of RA patients with high levels of rheumatoid factor titer which leads to respiratory failure.[5,6] Lung function was assessed by spirometry which is non-invasive and cost effective and helps in early diagnosis. It can be used to assess the prognosis of the respiratory involvement and provide a comfortable and healthy lifestyle.

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MATERIALS AND METHODS

The study was performed in Department of Physiology and Rheumatology, Outpatient Department in SRM Medical College Hospital and Research Centre. The study was performed in 100 participants, 50 healthy controls and 50 RA patients. Information regarding respiratory symptoms, duration of disease, drug history, blood investigations such as RA factor, C-reactive protein, anti-cyclic citrullinated peptide, and hemoglobin were obtained. Anthropometric measurements, physical examination, and assessment of lung function were performed on all the study participants. Lung function test was assessed by EasyOne Pro computerized spirometer.

The study was approved by the Institutional Ethical Committee. Written informed consent was obtained from all the participants.

Inclusion Criteria

- Proven RA patients on rheumatoid drugs (ARA Criteria, 2010)
- Absence of respiratory symptoms
- Age group – 25-60 years.

Exclusion Criteria

- Age <25 years, >60 years
- Smokers, alcoholics
- Pregnancy
- Any previous respiratory and cardiac disease
- Previous significant chest injury.

Procedure

The participant was made to relax and should wear comfortable loose clothing. The participant was made to sit comfortably and nose clip was applied on the nose. The spirette was kept in the mouth with the lips sealing around it. The participants were instructed to breathe calmly and care should be taken not to block or bite the spirette.

The participants were asked to do tidal breathing and fill the lungs completely and then asked to exhale as hard and fast as possible until the lungs were completely empty and inhale as hard and fast as possible till the end of the test. This test was repeated 2-3 times and the best value was taken for the result.

Statistical Analysis

The data collected were analyzed using Statistical Package for the Social Sciences version 21. Statistical analysis was performed using independent *t*-test to compare the lung function tests between the healthy controls (control group) and RA patients (experimental group). The $P < 0.05$ was considered as statistically significant.

RESULTS

The study was performed in 100 participants (50 control group and 50 experimental group). 85% were female participants and 15% were male participants. Table 1 describes about the anthropometric values of our study population. The mean age of the experimental group is 41.96 ± 7.99 years. The mean height and weight are 156.7 cm and 61.46 kg, respectively. The mean body mass index is 24.5± 6.0.

Table 2 shows the comparison of lung parameters between the control and experimental group. The mean of experimental group of forced vital capacity (FVC) was 2.2366 ± 0.59186, forced expiratory volume in 1 s (FEV1) was 1.7594 ± 0.51072, FEV1/FVC was 0.79 ± 0.13, forced expiratory flow in 25-75% (FEF 25-75%) was 1.756 ± 0.93667, peak expiratory flow rate (PEF) was 4.1528 ± 1.45828, FIVC was 1.7936 ± 0.95744, and PIF was 2.1346 ± 1.35958 were significantly lower when compared with the control group.

Figure 1 shows the pie chart about the ventilatory defect. About 64% of rheumatoid patients had restrictive ventilatory defect and 10% of rheumatoid patients had obstructive type. About 26% had normal lung function.

DISCUSSION

In this study, the pulmonary functions were performed in 50 rheumatoid patients and compared them with normal controls.

Restrictive ventilatory defect is seen in 64% of rheumatoid patients with FEV1/FVC >70% and reduced vital capacity and total lung capacity.

Obstructive ventilatory defect is seen in 10% of rheumatoid patients since the FEV1/FVC <80% with increased residual volume and total lung capacity ratio.

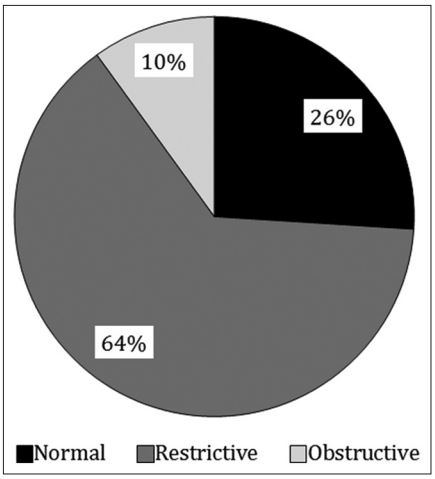

Figure 1: Ventilatory defects in experimental group

Table 1: The anthropometric measurements

Parameters	Groups	*N*	Mean±Standard deviation	Independent *t*-test	*P* value
Height	Control	50	163.4400±6.87545	4.522	0.0001
	Experimental	50	156.7000±7.98787		
Weight	Control	50	64.9200±10.08300	1.530	0.129
	Experimental	50	61.4600±12.41002		
BMI	Control	50	24.1900±3.63016	0.324	0.747
	Experimental	50	24.5116±6.00274		
Age	Control	50	39.1800±5.79123	1.990	0.049
	Experimental	50	41.9600±7.99990		

BMI: Body mass index

Table 2: The comparison of lung parameters

Parameters	Groups	*N*	Mean±Standard deviation	Independent *t*-test	*P* value
FVC	Control	50	3.2302±0.61001	8.266	0.0001
	Experimental	50	2.2366±0.59186		
FEV1	Control	50	2.7142±0.51323	9.325	0.0001
	Experimental	50	1.7594±0.51072		
FEV1/FVC	Control	50	0.8425±0.07708	2.454	0.016
	Experimental	50	0.7900±0.13036		
FEF 25-75%	Control	50	2.9526±0.74651	7.064	0.0001
	Experimental	50	1.7560±0.93667		
PEF	Control	50	6.5024±1.78818	7.200	0.0001
	Experimental	50	4.1528±1.45828		
FET	Control	50	5.5380±1.74799	0.881	0.381
	Experimental	50	6.0146±3.40398		
FIVC	Control	50	3.0764±0.83833	7.128	0.0001
	Experimental	50	1.7936±0.95744		
PIF	Control	50	3.7842±1.43782	5.895	0.0001
	Experimental	50	2.1346±1.35958		

FVC: Forced vital capacity, FEV1: Forced expiratory volume in 1 s, PEF: Peak expiratory flow rate, FET: Forced expiratory time, FEF 25-75%: Forced expiratory flow in 25-75%, FIVC: Forced inspiratory vital capacity, PIF: Peak inspiratory flow

Remaining 26% of participants were normal. Lung parameters such as FVC, FEV1, FEV1/FVC, FEF 25-75%, PEF, and FIVC were significantly lower in rheumatoid patients when compared with normal controls.

Fuld et al.[7] found that the prevalence of pulmonary function abnormalities was higher in asymptomatic rheumatoid patients when compared with the reference population. Avnon et al.[8] noted restrictive pulmonary abnormalities in 25.6%, small airway disease in 14.6%, and obstructive in 27%. Cortet et al.[9] and Radoux et al.[10] found small airway obstruction is seen in 50% of cases with decrease in FEF 25-75%. There was associated increase in antinuclear antibody.[10]

Restrictive ventilatory defect may be due to activation of immune complexes in the alveolar walls. It results in the release of myeloperoxidase, collagenase, and elastase. There is destruction of lung tissue by phagocytosis and protease – Antiprotease imbalance preventing the lung expansion. Banks et al.[11] stated restrictive type of lung disease with reduction in mid-expiratory flow. Restrictive pattern was seen with reduction in FEV1/FVC ratio.[8] Gowdhaman et al.[12] reported restrictive type with decrease in vital capacity.

Bilgici et al.[13] and Vergnenègre et al.[14] noted obstructive type of lung disease. Vergnenègre et al.[14] reported a significant reduction in FEF 25-75%, FEV1/FVC. In RA, obstructive ventilatory defect may be due to airway inflammation. Plasma immunoglobulin E level increases. Neuropeptides and chemokines are released from eosinophils, and mast cell damages the airway epithelium and hyperresponsiveness. This results in partially reversible airway obstruction due to bronchial narrowing. Devouassoux et al.[15] found that there is airflow obstruction with decreased FEV1/FVC and hyperinflation with increased residual volume and total lung capacity ratio. Cimen et al.[16] found airway obstruction in 28% of cases. Hassan et al.[17] reported that airway obstruction may

be due to mucosal edema as a result of airway inflammation which leads to bronchial narrowing.

The current study states that pulmonary manifestations are common in RA which is of restrictive type.

CONCLUSION

Pulmonary manifestations are one of the common extra-articular manifestation in RA. It is often asymptomatic. They can be evaluated with pulmonary function tests, chest radiography, and CT scan. In this study, restrictive ventilatory defect is more common than obstructive type. Pulmonary function test can be used as screening test for early detection of the abnormalities and disease activity.

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REFERENCES

1. Arnett FC, Edworthy SM, Bloch DA, McShane DJ, Fries JF, Cooper NS, et al. The American Rheumatism Association 1987 Revised Criteria for the classification of rheumatoid arthritis. Arthritis Rheum. 1988;31(1):315-24.
2. Gabriel SE. The epidemiology of rheumatoid arthritis. Rheum Dis Clin North Am. 2001;27(2):269-81.
3. Pappas DA, Giles JT, Connors G, Lechtzin N, Bathon JM, Danoff SK. Respiratory symptoms and disease characteristics as predictors of pulmonary function abnormalities in patients with rheumatoid arthritis: An observational cohort study. Arthritis research & therapy. 2010;12(3):R104.
4. Anaya JM, Diethelm L, Ortiz LA, Gutierrez M, Citera G, Welsh RA, et al. Pulmonary involvement in rheumatoid arthritis. Semin Arthritis Rheum. 1995;24(4):242-54.
5. Tanoue LT. Pulmonary manifestations of rheumatoid arthritis. Clin Chest Med. 1998;19(4):667-85, viii.
6. DuBois RM, Au W. Infiltrative and ILD. In: Murray JF, Nadel JA, editors. Textbook of Respiratory Medicine. Philadelphia, PA: W. B. Saunders Co.; 2000.
7. Fuld JP, Johnson MK, Cotton MM, Carter R, Watkin SW, Capell HA, et al. A longitudinal study of lung function in nonsmoking patients with rheumatoid arthritis. Chest. 2003;124(4):1224-31.
8. Avnon LS, Manzur F, Bolotin A, Heimer D, Flusser D, Buskila D, et al. Pulmonary functions testing in patients with rheumatoid arthritis. Isr Med Assoc J. 2009;11(2):83-7.
9. Cortet B, Perez T, Roux N, Flipo RM, Duquesnoy B, Delcambre B, et al. Pulmonary function tests and high resolution computed tomography of the lungs in patients with rheumatoid arthritis. Ann Rheum Dis. 1997;56(10):596-600.
10. Radoux V, Ménard HA, Bégin R, Décary F, Koopman WJ. Airways disease in rheumatoid arthritis patients. One element of a general exocrine dysfunction. Arthritis Rheum. 1987;30(3):249-56.
11. Banks J, Banks C, Cheong B, Umachandran V, Smith AP, Jessop JD, et al. An epidemiological and clinical investigation of pulmonary function and respiratory symptoms in patients with rheumatoid arthritis. Q J Med. 1992;85(307-308):795-806.
12. Gowdhaman N, Adikesavan B, Gopal MK, Meganathan M, Mohan J, Balamurugan K et al. A comparative study on pulmonary function in females with rheumatoid arthritis. World J Med Sci. 2011;6(4):209-13.
13. Bilgici A, Ulusoy H, Kuru O, Celenk C, Unsal M, Danaci M. Pulmonary involvement in rheumatoid arthritis. Rheumatol Int. 2005;25(6):429-35.
14. Vergnenègre A, Pugnere N, Antonini MT, Arnaud M, Melloni B, Treves R, et al. Airway obstruction and rheumatoid arthritis. Eur Respir J. 1997;10(5):1072-8.
15. Devouassoux G, Cottin V, Lioté H, Marchand E, Frachon I, Schuller A, et al. Characterisation of severe obliterative bronchiolitis in rheumatoid arthritis. Eur Respir J. 2009;33(5):1053-61.
16. Cimen B, Deviren SD, Yorgancloglu ZR. Pulmonary function tests, aerobic capacity, respiratory muscle strength and endurance of patients with rheumatoid arthritis. Clin Rheumatol. 2001;20(3):168-73.
17. Hassan WU, Keaney NP, Holland CD, Kelly CA. Bronchial reactivity and airflow obstruction in rheumatoid arthritis. Ann Rheum Dis. 1994;53(8):511-4.

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