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RESEARCH ARTICLE

Spirometry in adult systemic lupus erythematosus and its relation with disease duration: A cross-sectional study in Eastern India

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ABSTRACT

Background: Although symptomatic interstitial lung disease (ILD) complicates in 3–8% of patients with systemic lupus erythematosus (SLE), subclinical ILD is common and has been described in up to one-third of patients. **Aims and Objectives:** Objective was spirometric evaluation of adult SLE patients having no pulmonary symptoms. **Materials and Methods:** A cross-sectional study was carried out involving adult SLE. Forced vital capacity (FVC), forced expiratory volume in 1 s (FEV1), FEV1/FVC ratio, forced expiratory flow (FEF) between 25 and 75% of vital capacity ($FEF_{25–75\%}$), and peak expiratory flow rate (PEFR) were measured. Pearson's correlation analysis was used to determine the correlation of disease duration with spirometric parameters. **Results:** Of 74 patients (age 18–50 years), six were male. Mean age, height, and weight were 29.65 years, 154.1 cm, and 52.75 kg, respectively. Mean duration of the disease was 4.5 years. Sixty patients (five males among them) were in remission with SLE Disease Activity Index score of 0. None had chronic cough or any respiratory distress at rest or with day-to-day activities. Overall, 34 (46%) patients had normal spirometry. About 56% of female and 33% of male patients had abnormal spirometry. About 49% of female patients had restrictive pattern of abnormality while 9% had obstructive disease. All patients had normal PEFR. Disease duration did not significantly correlate with any of the spirometric parameters or their percent-predicted values. **Conclusion:** Periodic spirometry of adult SLE patients can be a cost-effective alternative in detecting subclinical pulmonary changes.

KEY WORDS: Systemic Lupus Erythematosus; Spirometry; Adult

INTRODUCTION

Systemic lupus erythematosus (SLE) is a multisystem autoimmune disorder with wide variation in clinical presentation. The disease commonly affects women of child-bearing age.[1] Pulmonary manifestation is common with nearly half of the patients affected during the course of disease.[2] It can involve pleura, airway, vessel, parenchyma, and respiratory muscles – all components of respiratory system.[3] Symptomatic interstitial lung disease (ILD) complicates in 3–8% of patients of SLE and shows progression with duration.[4] However, subclinical ILD is common and has been described in up to one-third of patients through a series of high-resolution computed tomography (HRCT).[5,6] Pulmonary involvement often goes unnoticed, especially in those without respiratory symptom.[7] Spirometry is a cheap and easily available tool even in resource-poor set up for screening of pulmonary function. The aim of this study was spirometric evaluation of adult SLE patients without pulmonary symptoms.

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MATERIALS AND METHODS

This was a cross-sectional study carried out in a tertiary care center in Eastern India after approval from the Institutional Ethics Committee. Adult-onset SLE patients (diagnosed after the age of 18) were included in the study. Severely ill and debilitated patients and those with pre-existing respiratory diseases, pregnancy, concurrent heart disease, and congenital defects such as cleft lip and palate or history of surgery on head, neck, or face were excluded from the study. Spirometry on those with respiratory tract infection or pleural effusion was performed after recovery.

Informed consent was taken from patients who were included in this study. All the disease-related and study-related queries of patients and their accompanying relatives were clarified to their full satisfaction. Efforts were given to remove all doubts and fear. A case record format was used to enter their required data.

Laboratory investigations included hematological and serological investigations, examination of urine, chest X-ray, echocardiography, and ultrasonography of abdomen. SLE Disease Activity Index (SLEDAI) score was used to evaluate disease activity.[8] The subjects were told not to take tea, coffee, and other stimulants and to come with light breakfast in the forenoon for spirometry. Spirometry was carried out using windows based digital spirometer – "Spirowin" (Genesis Medical Systems Pvt. Ltd.). After 5–10 min of rest, spirometry was performed in sitting posture with the nose manually closed by the patients. After demonstrating the procedure, patients were asked to inhale deeply and then exhale with maximum effort as much as possible into the mouthpiece. Inspiration was taken fast without any pause and then subjects were told to "blast" into the mouthpiece and encouraged to fully exhale using phrases like "keep going." The American Thoracic Society criteria for accessibility and repeatability of spirometry were followed without any compromise.[9] Individual spirograms were considered acceptable if they had satisfactory start and satisfactory exhalation with adequate effort. After obtaining a minimum of three acceptable spirograms, it was observed whether the two largest values of forced vital capacity (FVC) were within 0.150 L of each other or not. The procedure was repeated until the two largest values of FVC were within 0.150 L of each other. Patients with unacceptable spirometry and/or inadequate effort had to undergo repeat spirometry on the second or even third sitting few weeks or months later. Maneuver with largest sum of FVC and FEV1 was used. Predicted equation for spirometry in adults developed by one study was used to calculate predicted value and lower limit of normal for different spirometric parameters.[10]

Pearson's correlation analysis has been used to determine correlation of disease duration with spirometric parameters. $P < 0.05$ was considered statistically significant. Statistical analysis was done using the software GraphPad Prism Version 5, 2007.

RESULTS

Of 81 SLE patients initially enrolled, two were very sick and could not perform spirometry. Spirometry of five patients did not meet acceptability and repeatability criteria and was excluded from analysis. Of the remaining 74 patients (age 18–50 years), six were male. Mean age, height, and weight were 29.65 years, 154.1 cm, and 52.75 kg, respectively. Mean duration of the disease was 4.5 years. Sixty patients (five males) were in remission with SLEDAI score of 0. None had chronic cough or any respiratory distress at rest or with day-to-day activities.

Baseline and pulmonary parameters of female and male patients are shown in Table 1. Overall, 34 (46%) patients had normal spirometry. About 56% of female and 33% of male patients had abnormal spirometry. One female and one male patient had both decreased FVC and decreased FEV1/FVC.

Frequency of decreased FVC and other spirometric parameters in terms of percent-predicted value is depicted in Figure 1. Most of the patients with decreased FVC, FEV1, and forced expiratory flow $(FEF)_{25–75\%}$ had these parameters above 60% of predicted. All patients had normal peak expiratory flow rate.

Spirometric profile of female SLE patients according to disease duration is shown in Table 2. Most of the patients had disease duration of <2 years. Most of the patients with longer disease duration had SLEDAI score of 0.

Table 3 shows that disease duration had mild negative correlation with most of the spirometric parameters or their

Table 1: Baseline and pulmonary parameters of SLE patients

Parameter	Female (*n*=68)	Male (*n*=6)
Age (years)	27.5 (22–33.75)	40.5 (34–46.5)
Height (cm)	152 (148–157)	178 (160–182.5)
Weight (kg)	50 (42.73–57.95)	72 (62.5–74.5)
Duration (years)	3 (1–6)	4.5 (1–7.25)
SLEDAI score	0 (0–0)	0 (0–0.25)
FVC (L)	2.133 (1.867–2.381)	3.596 (2.693–3.842)
FEV1 (L)	1.847 (1.594–2.160)	3.036 (2.066–3.140)
FEV1/FVC (%)	85.33 (82.92–91.11)	82.96 (78.87–87.20)
$FEF_{25–75\%}$ (L/s)	2.192 (1.616–2.717)	3.483 (2.066–4.213)
PEFR (L/s)	4.039 (3.424–4.829)	6.453 (5.488–7.704)
Normal spirometry	30 (44)	4 (67)
Decreased FVC	33 (49)	2 (33)
Decreased FEV1	28 (41)	2 (33)
Decreased FEV1/FVC	6 (9)	1 (17)
Decreased $FEF_{25–75\%}$	27 (40)	2 (33)
Decreased PEFR	0 (0)	0 (0)

Values are median (interquartile range) or frequency (%).
PEFR: Peak expiratory flow rate, SLEDAI: SLE disease activity index, FVC: Forced vital capacity, FEV1: Forced expiratory volume in 1, FEF: Forced expiratory flow

percent-predicted values, but those did not reach the level of significance. Scatter plot of different parameters with duration is shown in Figure 2.

DISCUSSION

This study revealed abnormal spirometry in 54% of patients with none having respiratory distress in day-to-day activities.

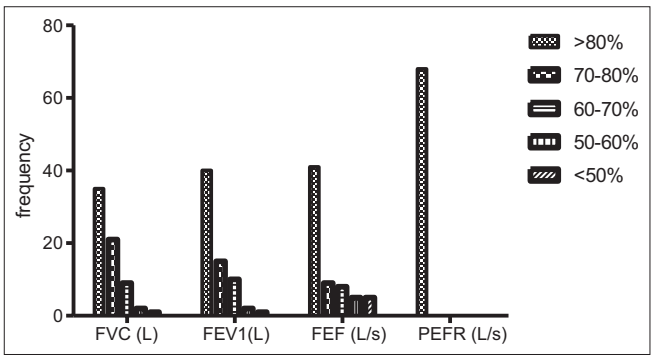

Figure 1: Frequency of spirometric parameters in terms of percent-predicted value

About 49% of female subjects had possible restrictive disease while 9% had obstructive pattern of abnormality. $FEF_{25–75\%}$ was decreased in 40% of female patients. Only 3 of 68 female patients had FVC below 60% of predicted indicating severe disease. About 53% of female patients with disease duration of 2 years or less had restrictive pattern of spirometry indicating early asymptomatic pulmonary involvement. Duration of disease did not correlate with FVC%, FEV1%, and FEV1/FVC.

Female-to-male ratio in adult SLE has been reported to be 9:1 that gradually decreases to 5:1 with disease onset of 50 years of age.[1,11,12] In this study, female patients were younger (median 27.5 vs. 40.5 years) and female-to-male ratio was 11:1. Symptomatic and asymptomatic pulmonary manifestations are described in 20–90% of adult SLE.[13,14] Increased risk of chronic obstructive pulmonary disease has also been described in SLE.[15] Progressive decline in $FEF_{25-75\%}$ indicating that small airway disease in adult SLE patients has been reported earlier.[16] These findings are similar to ours. Although pulmonary involvement is common, the prevalence and severity of diffuse ILD appears to be lower in SLE than in the other connective tissue disorders.[17,18] This is

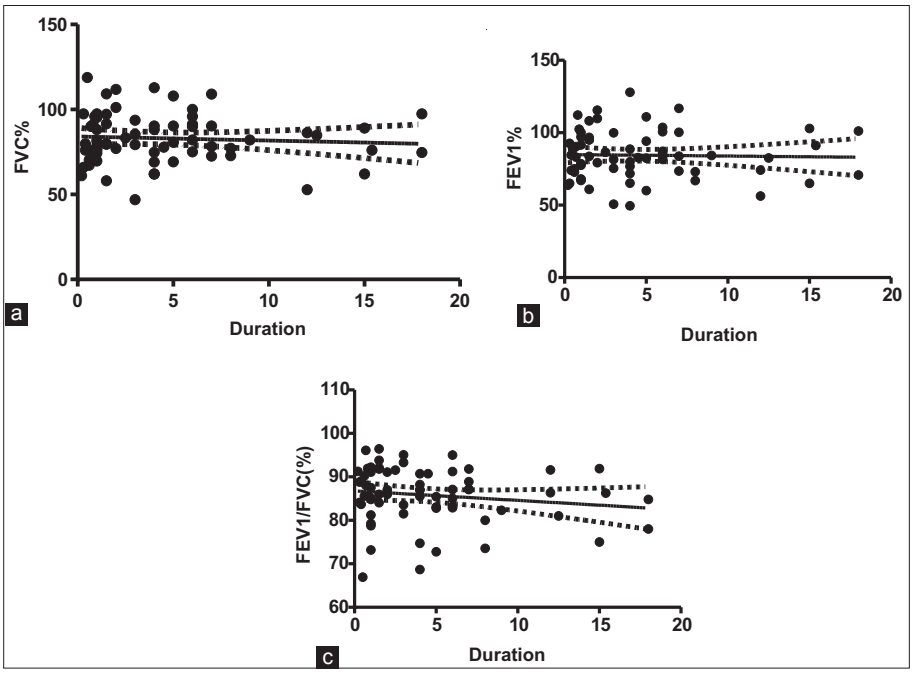

Figure 2:(a-c) Scatter plot disease duration versus forced vital capacity (FVC)% (of predicted), forced expiratory volume in 1% (of predicted), and forced expiratory volume in 1/FVC (%)

Table 2: Spirometric profile of female SLE patients (*n*=68) according to disease duration

Duration(years)	Number of patients	Patients with SLEDAI score 0	Patients with normal spirometry	Decreased FVC	Decreased FEV1	Decreased FEV1/FVC
≤2	30 (44)	20 (29)	12 (18)	16 (24)	13 (19)	3 (4)
2–4	12 (18)	12 (18)	4 (6)	6 (9)	6 (9)	2 (3)
4–6	11 (16)	9 (13)	7 (10)	3 (4)	3 (4)	1 (1)
6–8	6 (9)	6 (9)	2 (3)	4 (6)	3 (4)	0 (0)
>8	9 (13)	8 (12)	5 (7)	4 (6)	3 (4)	0 (0)

Values are frequency (%). SLEDAI: SLE disease activity index, FVC: Forced vital capacity, FEV1: Forced expiratory volume in 1, FEF: Forced expiratory flow

Table 3: Correlation of disease duration with respiratory parameters

Parameters	Pearson's r	*P* value
FVC%	−0.073	0.55
FEV1%	−0.028	0.82
FEV1/FVC	−0.155	0.21
$FEF_{25-75\%}$	0.045	0.72
PEFR%	−0.034	0.78

PEFR: Peak expiratory flow rate, FEF: Forced expiratory flow, FVC: Forced vital capacity, FEV1: Forced expiratory volume in 1

analogous to our result where severe restrictive pattern was uncommon (4%). Subclinical ILD can affect one-third of patients as demonstrated by series of HRCT.[5,6] Almost half of female patients with none having pulmonary symptoms had possible restrictive disease in this study. Even though disease duration did not correlate with respiratory parameters, there are earlier reports of progressive decline in spirometric parameters with duration.[19]

Small number of male patient is a limitation of this study. ILD has been found to be more common in late-onset diseases, but this could not be substantiated because most of the female patients (82%) had disease onset before 30 years. Restrictive disease could not be confirmed by diffusing capacity for carbon monoxide (DLCO) and HRCT in all patients. DLCO and HRCT could not be done due to lack of facility and financial constraint.

CONCLUSION

As a cheap and easily available screening test, spirometry is capable of early detection of pulmonary involvement. Periodic spirometric assessment of adult SLE patients can be a cost-effective alternative in identifying subclinical pulmonary changes in resource limited set up. Early detection of patients who are likely to develop ILD in future by timely screening could guide the treatment at the outset.

REFERENCES

1. Siegel M, Lee SL. The epidemiology of systemic lupus erythematosus. Semin Arthritis Rheum 1973;3:1-54.
2. Vitali C, Bencivelli W, Isenberg DA, Smolen JS, Snaith ML, Sciuto M, *et al.* Disease activity in systemic lupus erythematosus: Report of the consensus study group of the European workshop for rheumatology research. I. A descriptive analysis of 704 European lupus patients. European consensus study group for disease activity in SLE. Clin Exp Rheumatol 1992;10:527-39.
3. Torre O, Harari S. Pleural and pulmonary involvement in systemic lupus erythematosus. Presse Med 2011;40:e19-29.
4. Jacobsen S, Petersen J, Ullman S, Junker P, Voss A, Rasmussen JM, *et al.* A multicentre study of 513 Danish patients with systemic lupus erythematosus. I. Disease manifestations and analyses of clinical subsets. Clin Rheumatol 1998;17:468-77.
5. Fenlon HM, Doran M, Sant SM, Breatnach E. High-resolution chest CT in systemic lupus erythematosus. AJR Am J Roentgenol 1996;166:301-7.
6. Bankier AA, Kiener HP, Wiesmayr MN, Fleischmann D, Kontrus M, Herold CJ, *et al.* Discrete lung involvement in systemic lupus erythematosus: CT assessment. Radiology 1995;196:835-40.
7. Nakano M, Hasegawa H, Takada T, Ito S, Muramatsu Y, Satoh M, *et al.* Pulmonary diffusion capacity in patients with systemic lupus erythematosus. Respirology 2002;7:45-9.
8. Bombardier C, Gladman DD, Urowitz MB, Caron D, Chang CH. Derivation of the SLEDAI. A disease activity index for lupus patients. The committee on prognosis studies in SLE. Arthritis Rheum 1992;35:630-40.
9. Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, *et al.* Standardisation of spirometry. Eur Respir J 2005;26:319-38.
10. Chhabra SK, Kumar R, Gupta U, Rahman M, Dash DJ. Prediction equations for spirometry in adults from Northern India. Indian J Chest Dis Allied Sci 2014;56:221-9.
11. McCarty DJ, Manzi S, Medsger TA Jr., Ramsey-Goldman R, LaPorte RE, Kwoh CK, *et al.* Incidence of systemic lupus erythematosus. Race and gender differences. Arthritis Rheum 1995;38:1260-70.
12. Danchenko N, Satia JA, Anthony MS. Epidemiology of systemic lupus erythematosus: A comparison of worldwide disease burden. Lupus 2006;15:308-18.
13. Swigris JJ, Fischer A, Gillis J, Meehan RT, Brown KK. Pulmonary and thrombotic manifestations of systemic lupus erythematosus. Chest 2008;133:271-80.
14. Memet B, Ginzler EM. Pulmonary manifestations of systemic lupus erythematosus. Semin Respir Crit Care Med 2007;28:441-50.
15. Shen TC, Lin CL, Chen CH, Tu CY, Hsia TC, Shih CM, *et al.* Increased risk of chronic obstructive pulmonary disease in patients with systemic lupus erythematosus: A population-based cohort study. PLoS One 2014;9:e91821.
16. Eichacker PQ, Pinsker K, Epstein A, Schiffenbauer J, Grayzel A. Serial pulmonary function testing in patients with systemic lupus erythematosus. Chest 1988;94:129-32.
17. Castelino FV, Varga J. Interstitial lung disease in connective tissue diseases: Evolving concepts of pathogenesis and management. Arthritis Res Ther 2010;12:213.
18. Praba PK, Selvi KT, Anand BV, Saravanan A. Evaluation of lung function tests in rheumatoid arthritis patients. Natl J Physiol Pharm Pharmacol 2017;7:693-6.
19. Jacobsen S, Petersen J, Ullman S, Junker P, Voss A, Rasmussen JM, *et al.* A multicentre study of 513 Danish patients with systemic lupus erythematosus. II. Disease mortality and clinical factors of prognostic value. Clin Rheumatol 1998;17:478-84.

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