Original Article

Pulmonary function test and HRCT findings in patients with systemic lupus erythematosus

Manohar Joshi[1], Manish Pendse[2*], Gayatri Pendse[3]

{[1]Assistant Professor, [2]Associate Professor, Department of Medicine}, {Assistant Professor, Department of Conservative Dentistry}
Dr DY Patil Medical College, Nerul, Navi Mumbai, Maharashtra, INDIA.
Email: drmanishpendse@gmail.com

Abstract

Objectives: To study the findings of Pulmonary function test and HRCT in patients with systemic lupus erythematosus. **Materials and Method:** The patients attending outpatient departments or admitted to wards during the period, who fulfilled the revised ACR criteria for classification of SLE were included in the study. Detailed medical history including age, sex, age of onset, duration of illness and various clinical presentations especially pulmonary manifestations (e.g. cough, chest pain, dyspnea and cyanosis) was recorded in a preformed proforma. Thorough clinical examination with special attention to chest examination was performed in all the study patients. Plain X-ray chest and HRCT was performed in all the patients. Pulmonary function tests also performed in all the patients and the findings observed were recorded. **Results:** Majority of the patients were in the age group of 15-30 years of age (48%) followed by 31-45 years of age (44%). The female to male ratio was 7.33:1. Symptom of pulmonary manifestations were seen in 28% patients. Pulmonary function test with decreased diffusion lung capacity was positive in 68% patients. HRCT was found to have interstitial lung pattern in 72% patients. The sensitivity of PFT 94.44% and specificity of 100% in diagnosing the pulmonary manifestation. The two-sided P value is < 0.0001, considered extremely significant. **Conclusion:** PFT and HRCT showed pulmonary manifestations positive in 68% and 72% patients. The sensitivity of PFT in diagnosing the pulmonary manifestation was 94.44% with specificity of 100%. Thus PFT can be used as effective tool in diagnosing asymptomatic pulmonary manifestation as HRCT.

Key Words: systemic lupus erythematosus, Pulmonary function test, HRCT, pulmonary manifestation.

[*]**Address for Correspondence:**
Dr. Manish Pendse, Associate Professor, Department of Medicine, Dr DY Patil Medical College, Nerul, Navi Mumbai, Maharashtra, INDIA.
Email: drmanishpendse@gmail.com

Received Date: 28/12/2016 Revised Date: 17/01/2017 Accepted Date: 18/02/2017

Access this article online

Quick Response Code:

Website: www.medpulse.in

DOI: 19 February 2017

INTRODUCTION

Systemic lupus erythematosus is a chronic autoimmune connective tissue disease that can affect any part of the body. As occurs in other autoimmune diseases, the immune system attacks the body's cells and tissue, resulting in inflammation and tissue damage. At some time during their course, most patients with SLE show signs of involvement of the lung, its vasculature, the pleura, and/or the diaphragm. Pleurisy, coughing, and/or dyspnoea are often the first clues to either lung involvement or SLE itself. In some cases, however, abnormal pulmonary function tests, including the diffusing capacity for carbon monoxide (DLCO) and/or abnormal chest X-rays may be detected in asymptomatic patients. Pulmonary abnormalities do not correlate with immune parameters**.** Lungs are involved in almost half of the patients during the disease course. Pulmonary manifestations may be the presenting symptoms in 4–5% of patients. High resolution computed tomography (HRCT) has made a significant impact on the early diagnosis of pulmonary involvement in SLE. Regardless of clinically identifiable pulmonary disease, abnormal respiratory physiology is a common finding in SLE.[1,2] In the first of three major studies demonstrating the high frequency of abnormal lung function, 88% of 43 consecutive SLE patients were found to have pulmonary dysfunction; the most common abnormality was a reduction in diffusing capacity of carbon monoxide

How to site this article: Manohar Joshi, Manish Pendse, Gayatri Pendse. Pulmonary function test and HRCT findings in patients with systemic lupus erythematosus. *MedPulse – International Medical Journal.* February 2017; 4(2): 263-267. http://www.medpulse.in (accessed 20 February 2017).

(DLCO) (72%), followed by a restrictive (49%), and an obstructive (9%) pattern on pulmonary function test (PFT).[2] Another study of 70 nonsmoking asymptomatic SLE patients with normal chest radiograph found 67% with an isolated reduction in DLCO and 6% had a restrictive pattern.[3] Finally, in a retrospective study of 110 Japanese SLE patients, an abnormal DLCO and restrictive changes were found in 47 and 8% of patients, respectively; only 13% of patients with PFT abnormalities exhibited clinical features, in particular radiographic evidence, of pulmonary involvement.[4] In a small case–control study, Rolla *et al* discovered that greater SLE disease activity may be associated with abnormal lung function and that lung function abnormalities respond to escalation of immunosuppressive treatment targeted at overall SLE disease activity.[5] However, the specific mechanisms and/or pathogenesis of lung function abnormalities among SLE patients without overt clinical symptoms and signs of pulmonary involvement are not well understood. PFTs may be a sensitive method to capture subclinical lung involvement and we propose that abnormal lung function among select patients (those with the absence of parenchymal involvement) may actually represent the milder spectrum of SLS, a specific pulmonary feature of SLE.

MATERIALS AND METHOD

This study was conducted in the Department of Medicine. All Patients attending outpatient departments or admitted to wards during the period, who fulfilled the revised ACR criteria for classification of SLE were included in the study. Patients who were Pregnant or suffering from occupational lung diseases or known case of hypertension, diabetic mellitus and cardiac diseases were excluded from the study. Thus total 25 cases were selected in the preset study. Detailed medical history including age, sex, age of onset, duration of illness and various clinical presentations especially pulmonary manifestations (e.g. cough, chest pain, dyspnea and cyanosis) was recorded in a preformed proforma. Thorough clinical examination with special attention to chest examination was performed in all the study patients. Necessary laboratory investigations were performed accordingly. Plain X-ray chest and HRCT was performed in all the patients. Pulmonary function tests also performed in all the patients and the findings observed were recorded. The collected data was entered in Microsoft excel and was analysed and presented with appropriate tables and graphs.

RESULTS

Table 1: Age and sex distribution

Variable		Number of Patient	Percentage
Age	15-30	12	48%
	31-45	11	44%
	>46	2	8%
Sex	Male	3	12%
	Female	22	88%

In the present study total 25 cases of systemic lupus erythematosus and it was observed that majority of the patients were in the age group of 15-30 years of age (48%) followed by 31-45 years of age (44%). The proportion of female was more as compared to male with female to male ratio of 7.33:1.

Table 2: Distribution according to lung involvement

Pulmonary manifestations		Number of Patient	Percentage
Symptomatic lung involvement	Positive	7	28%
	Negative	18	72%
PFT	Positive	17	68%
	Negative	8	32%
HRCT	Positive	18	72%
	Negative	7	28%

It was seen that 7 (28%) patients in the study were presenting with symptom of pulmonary manifestations. Out of them 6 were female patients and 1 was male. The most common symptom observed was cough followed by exertional dyspnoea and chest pain. Pulmonary function test with decreased diffusion lung capacity which suggests restrictive lung pattern was positive in 17 (68%) patients out of the 25 patients. HRCT is found to have interstitial lung pattern in 18 (72%) patients out of the 25 patients.

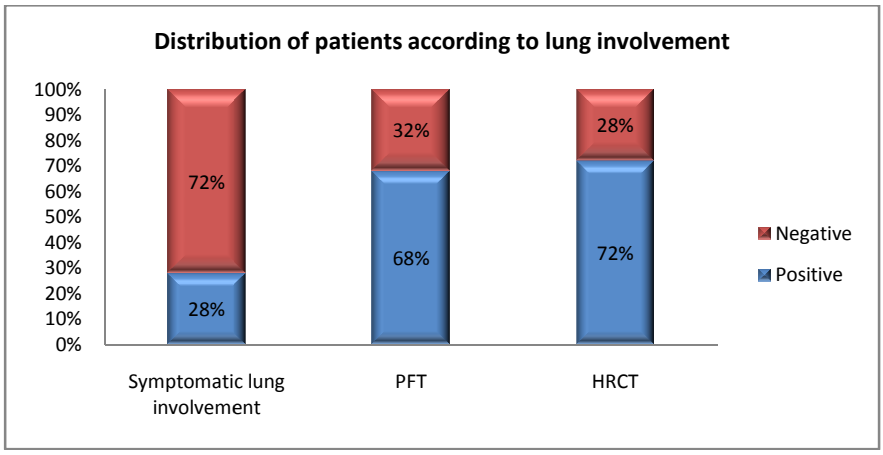

Figure 1:

Table 3: Comparison of Symptomatic lung involvement with PFT and HRCT

Pulmonary manifestations		Symptomatic lung involvement	
		Positive	Negative
PFT with DLCO	Positive	7	10
	Negative	0	8
HRCT	Positive	7	11
	Negative	0	7

It was observed that out of total 17 patients were positive on PFT out of them 7 were symptomatic and 10 were asymptomatic. Out of 18 patients positive for lung disease on HRCT 8 were symptomatic and 10 were asymptomatic. Thus HRCT evaluation in asymptomatic (pulmonary involvement) SLE patients helps to pick up interstitial lung disease at an early stage.

Table 4: Comparison of the HRCT with PFT

TITELS	HRCT +VE	HRCT – VE	chi-square tests
PFT +VE	**17**	**0**	X^2=20.66, df=1, p= 0.000
PFT -VE	**1**	**7**	(significant)

Sensitivity= 94.44%, Specificity= 100.00 %, Positive Predictive Value= 100.00%, Negative Predictive Value= 87.50 %

It was observed that out of total 18 patients positive on HRCT 17 were also positive on PFT, thus the true positive was 17. HRCT and PFT negative patients were 7, thus true negative was 7. The sensitivity of PFT 94.44% and specificity of 100% in diagnosing the pulmonary manifestation. The two-sided P value is < 0.0001, considered extremely significant.

DISCUSSION

In the present study total 25 patients of systemic lupus erythematosus admitted to the study institute were evaluated. It was seen that out of 25 patients 22 were females and only 3 were male, thus the disease is commoner in females with female to male ratio of 7.33:1. Majority of the female were of chid bearing age group. Samiha Samuel *et al*[6], Al Abbad *et al*,[7] and Omer S.B *et al*[8] also observed similar findings in their study. The most common symptom observed was cough followed by exertional dyspnoea and chest pain. It was seen that 7 (28%) patients in the study were presenting with symptom of pulmonary manifestations. Out of them 6 were female patients and 1 was male. Similar findings were also reported by Al Abbad *et al*,[7] and Omer S.B *et al*[8] in their study. Samiha Samuel *et al*[6] observed exertional dyspnea, productive cough and chest pain as commonest presenting symptom. Delgado *et al*[9] also observed similar symptoms in their study. Any part of the pulmonary system can be affected including airways, lung parenchyma, pulmonary vasculature, pleura and diaphragm.[10-16] If SLE develops after age 49 years, it has a higher incidence of serositis, pulmonary involvement and mortality.[16] It is difficult to find out the true prevalence of pulmonary complications of SLE since many cases are due to infections.[12] It was seen that 7 (28%) patients in the study were presenting with symptom of pulmonary manifestations. Out of them 6 were female patients and 1 was male. The most common symptom observed was cough followed by exertional dyspnoea and chest pain. Pulmonary function test with decreased diffusion lung capacity which suggests restrictive lung pattern was positive in 17 (68%) patients out of the 25 patients. Samiha Samuel *et al*[6] also observed similar findings in their study. These results were also similar to those detected by Karim *et al*[17], where lung volumes were reduced on pulmonary function tests in restrictive pattern. HRCT is found to have interstitial lung pattern in 18 (72%) patients out of the 25 patients. Fenlon HM[18] reported 70% and Sant SM[19] reported 72% patients to have interstitial lung pattern diagnosed on HRCT. Cheema and Quismorio,[20] reported that high resolution computed tomographic scans of the chest and pulmonary function tests help to establish a diagnosis and aid long term follow up of SLE patients with acute lupus

pneumonitis and diffuse interstitial lung disease which has a major impact on the mortality and morbidity of SLE patients. Increasing evidence suggests that certain patterns of interstitial lung disease seen on HRCT correlatee well with findings on open lung biopsy and may help predict response to treatment and patient outcome[21,22]. Ground glass opacification, seen in two of our patients, generally reflects active alveolitis with predominantly inflammatory changes on lung biopsy and steroid responsiveness. Conversely, a predominantly reticular pattern is seen in patients whose outcome is that of usual interstitial pneumonitis and is, in general, less favourable, with a poor response to immunosuppression.[18] Nakano M *et al*[23] conducted a study with the aim clarify the characteristics of pulmonary function tests (PFT), especially carbon monoxide diffusion capacity (DLCO), and their correlation with clinical features and immunological findings in patients with systemic lupus erythematosus (SLE). Vital capacity (VC) and DLCO were analysed retrospectively in 110 sequential Japanese SLE patients with active disease. In 38 patients, serial measurements of PFT were also assessed during high-dose corticosteroid therapy. DLCO was reduced in 52 patients (47%) and a restrictive impairment of PFT was observed in nine patients (8%). The prevalence of pulmonary fibrosis was 13%. Patients with Raynaud's phenomenon showed a higher prevalence of DLCO impairment than those without this phenomenon. G.C. Ooi *et al*[24] conducted a study among the patients with systemic lupus erythematosus (SLE) with persistent respiratory symptoms and evaluated them with high resolution computed tomography (HRCT), chest radiographs and lung function tests. They observed that fourteen of 15 HRCT scans performed were abnormal. Three of 10 patients had histological evidence of either lung fibrosis or interstitial pneumonitis. All concurrent lung function tests were abnormal. Reduced diffusion capacity of carbon monoxide (DLCO/VA) was observed in 60% of lung function tests. The study had documented a high incidence of HRCT features of chronic lung destruction and lower zone predominance in SLE patients with persistent respiratory symptoms. Sant SM *et al*[19] assessed the nature of pleuropulmonary abnormalities, with particular reference to interstitial lung disease (ILD), in patients with systemic lupus erythematosus (SLE). Total 29 patients were evaluated using high resolution computed tomography (HRCT), plain chest radiography (CXR) and pulmonary function tests (PFTs). The HRCT was abnormal in 72% (20/29) of patients, while 34% (10/29) had an abnormal CXR. The most frequently detected primary HRCT abnormality was suggestive of ILD and was noted in 11 patients (38%). HRCT was found to be more sensitive than PFTs or CXR in the evaluation of pleuropulmonary disease in SLE. Kakati *et al*[25] studied thirty-eight patients fulfilling the ACR criteria for SLE using chest X-ray, PFT and HRCT chest to find out the pulmonary involvement. Thirty-five out of 38 patients were females. Clinical signs and symptoms referable to pulmonary involvement were present in 9 patients. HRCT showed abnormalities in 21 patients in contrast to pulmonary function abnormalities in 11 patients and chest X-ray abnormalities in 7 patients. The abnormalities on HRCT included interstitial lung disease in 15 patients, bronchiectasis in 3, pneumonia in 2, and pleural abnormalities in 7 patients. The overall pulmonary involvement was observed in 22 patients of whom HRCT detected abnormalities in 21 patients. Pulmonary involvement is present in a significant number of SLE patients as detected by HRCT. However, in the majority, it is asymptomatic.

CONCLUSION

Thus from the above results and discussion we conclude that PFT and HRCT showed pulmonary manifestations positive in 68% and 72% patients. The sensitivity of PFT in diagnosing the pulmonary manifestation was 94.44% with specificity of 100%. Thus PFT can be used as effective tool in diagnosing asymptomatic pulmonary manifestation as HRCT.

REFERENCES

1. Groen H, ter Borg EJ, Postma DS, Wouda AA, van der Mark TW, Kallenberg CG. Pulmonary function in systemic lupus erythematosus is related to distinct clinical, serologic, and nailfold capillary patterns. Am J Med 1992;93(6):619–627
2. Silberstein SL, Barland P, Grayzel AI, Koerner SK. Pulmonary dysfunction in systemic lupus erythematosus: prevalence classification and correlationwith other organ involvement. J Rheumatol 1980;7(2):187–195
3. Andonopoulos AP, Constantopoulos SH, Galanopoulou V, Drosos AA, Acritidis NC, Moutsopoulos HM. Pulmonary function of nonsmoking patientswith systemic lupus erythematosus. Chest 1988;94(2):312–315
4. Nakano M, Hasegawa H, Takada T, et al. Pulmonary diffusion capacity in patients with systemic lupus erythematosus. Respirology 2002;7(1):45–49
5. Rolla G, Brussino L, Bertero MT, Bucca C, Converso M, Caligaris-Cappio F. Respiratory function in systemic lupus erythematosus: relation with activity and severity. Lupus 1996;5(1):38–43
6. Samiha Samuel, Mona Mohsen, Rasha M. Gamal El-Din, Hossam Hosny. Pulmonary Function Tests In Patients with Systemic Lupus Erythematosus (SLE) Alexandria Journal of Pediatrics, 2005; 19(2): 277-281.
7. AL-Abbad AJA, Cabral PA, Sanatanis et al. Echocardiography and pulmonary function testing in childhood onset SLE. Lupus 2000; 10: 32-7.

8. Omer S.B. Alamoudi, Suzan M. Attar. Pulmonary manifestations in systemic lupus erythematosus: Association with disease activity. Respirology. 2015; 20: 474–480
9. Degado EA, Malleson PN, Pirie GE, Petty RE. Pulmonary manifestations of childhood onset systemic lupus erythermatosus. Semin Arthritis Rheum 1990; 29: 285-93.
10. Haupt, H. M., Moore, G. W., and Hutchins, G. M. (1981) The lung in systemic lupus erythematosus. Analysis of the pathologic changes in 120 patients. Am J Med 71: 791-798.
11. Orens JB, Martinez FJ, Lynch JR Pleuropulmonary manifestations of systemic lupus erythematosus. Rheum Dis Clin North Am 1994;20:159-193
12. Quadrelli, S. A., Alvarez, C., Arce, S. C., Paz, L., Sarano, J., Sobrino, E. M., and Manni, J. (2009) Pulmonary involvement of systemic lupus erythematosus: analysis of 90 necropsies. Lupus 18: 1053-1060.
13. Gross, M., Esterly, J. R., and Earle, R. H. (1972) Pulmonary alterations in systemic lupus erythematosus. Am Rev Respir Dis 105: 572-577.
14. Kamen, D. L., and Strange, C. (2010) Pulmonary manifestations of systemic lupus erythematosus. Clin Chest Med 31: 479-488.
15. Weinrib I, Sharma OP, Quismorio FR A long-term study of intersthal lung disease in systemic lupus erythematosus. SeminArthritis Rheum1990; 20:48-56
16. Boddaert, J., Huong, D. L., Amoura, Z., Wechsler, B., Godeau, P., and Piette, J. C. (2004) Lateonset systemic lupus erythematosus: a personal series of 47 patients and pooled analysis of 714 cases in the literature. Medicine (Baltimore) 83: 348-359.
17. Karim MY, Miranda LC, Tench CM et al. Presentation and prognosis of the shrinking lung syndrome in SLE. Semin Arthritis Rheum 2002; 31(5): 289-98.
18. Fenlon HM, Doran M, Sant SM, Breatnach E. High-resolution chest CT in systemic lupus erythematosus.AJR Am J Roentogenol 1996;166:301-07.
19. Sant SM, Doran M, Fenlon HM, Bratnach ES. Pleuropulmonary abnormalities in patients with systemic lupus erythematosus: assessment with high resolution computed tomography, chest radiography and pulmonary function tests. Clin Exp Rheumatol. 1997;15:507-13
20. Cheema GS, Quismorio FP Jr. Interstitial lung disease in SLE. Curr Opin Pulm Med 2000; 6(5): 424-9
21. Wells AU, Hansell DM, Aubens MB, et al. The predictive value of appearances on thin section computed tomography in fibrosing alveolitis. Am Rev RespirDis 1993; 148:1076-1 082.
22. Wells AU, Hansell DM, Comn B. High resolution computed tomography as a predictor of lung histology in systemic sclerosis. Thorax 1992; 47:738-742.
23. Nakano M; Hasegawa H; Takada T; Ito S; Muramatsu Y; Satoh M; Suzuki E; Gejyo F. Pulmonary diffusion capacity in patients with systemic lupus erythematosus. Respirology 2002 Mar; 7(1):45-9.
24. G.C. Ooi, H. Ngan, W.C.G. Peh, M.Y. Mok and M. Ip. Systemic lupus erythematosus patients with respiratory symptoms: the value of HRCT. Clinical Radiology. 1997; 52:775-81.
25. S Kakati, B Doley, P Dihingia, U Pegu, S Pal, UJ Deka. A clinical study of pulmonary manifestations in systemic lupuserythematosus with special reference to CT findings. Indian Journal of Rheumatology. 2007; 2(4): 133-136.

Source of Support: None Declared
Conflict of Interest: None Declared