Research Article

Role of High Resolution CT Chest in Early Detection of Pulmonary Involvement in Systemic Lupus Erythematosus Patients

Eglal M. Shawky*, Mahmoud S. Abd-El Alim*, Hala A. Mohamed, Aml A. Hassan*** and Nasr M. Osman******

* Department of Internal Medicine, Faculty of Medicine, Minia University, Egypt.
** Department of Chest, Faculty of Medicine, Minia University, Egypt.
*** Department of Rheumatology & Rehabilitation, Faculty of Medicine Minia University, Egypt.
**** Department of Radiology; Faculty of Medicine, Minia University, Egypt.

Abstract

Background: Pulmonary disease may complicate SLE and is an important cause of morbidity and mortality. The most common pulmonary manifestation attributable to SLE is pleuritis, but other pleural involvement can be seen, as well as parenchymal disease, pulmonary vascular disease, diaphragmatic dysfunction, and upper airway dysfunction. Finding the true prevalence of lung involvement with SLE is complicated by the high rates of pulmonary infections. The Aim of the present study is to estimate the role of high resolution computed tomography (HRCT) in early detection of pulmonary involvement in SLE patients. **Methods**: The study population consisted of fifty (٥٠) female patients with SLE were taken from Internal medicine and Rheumatology department in Minia university hospital from august ٢٠٠٨ to September ٢٠١١, their main age was ٢٤.٢ years ± ٧.٤ and their main disease duration was ٢٨.٤ months ±٢٤.٦٥. All patients have no or mild respiratory symptoms at the time of study in the form of cough, dyspnea and chest pain. They were studied retrospectively to review the disease course, the clinical manifestation, laboratory investigations. The chest radiogragh and HRCT images were assessed by radiologist. **Results:** The patients age ranged between ١٥-٥١ years with a mean of ٢٤.٢±٧.٤. The disease duration ranged between ٢-١٢٠ months with a mean of ٢٨.٤±٢٤.٦٥. As regard High resolution computed tomography show finding of HRCT in patients with +ve clinically pulmonary findings (symptomatic) and patients without clinically pulmonary findings (asymptomatic), it show normal HRCT in ١٨(٣٦٪) ١٠ symptomatic and ٨ in asymptomatic patients. Pleural disease in ١٤(٢٨٪) ٦ symptomatic and ٨ asymptomatic patients. ILD in ٢٦(٥٦٪) ٢٠ symptomatic and ٦ asymptomatic patients. Airway disease in ٢(٤٪) present only in asymptomatic patients. Pneumonia in ٨(١٦٪) ٤symptomatic and ٤ asymptomatic patients. **Conclusion:** The increase sensitivity of HRCT in visualizing parenchymal disease especially ILD has been confirmed.

Keywords: SLE, Pulmonary manifestation, HRCT and ILD.

Introduction

Systemic lupus erythematosus (SLE) is a chronic autoimmune disease with strong genetic and environmental components[١-٤]. Systemic lupus erythematosus (SLE) is a clinical syndrome with a complex, multifactorial etiology, characterized by inflamemation and involvement of multiple organ systems. SLE involves mainly the skin, joints, kidneys, lungs, heart, central nervous system and haemopoeitic system[٥].

Pulmonary problems are common in SLE and may be the presenting feature of this multisystemic disease. The recognition of pulmonary disease involvement dates back to ١٩٠٤, when Sir William Osier reported a ٢٤ year old woman with bilateral pulmonary consolidation and haemoptysis associated with skin rash, anemia and nephritis. Respiratory disease in SLE may be due to direct involvement or as a conesquence of disease affecting other organ system. The clinical spectrum ranges from mild, self-limited, pleuritic, chest pain to fulminant and rapidly fatal, diffuse, pulmonary hemorrhage[٦].

Several studies have shown the increased sensitivity of high resolution computed tomography (HRCT) of the chest compared with plain chest radiography in identifying interstitial lung disease. HRCT improves visualization of small parenchymal structures allowing evaluation and grading of the severity of diffuse infiltrative lung disease[٧-٩].

In the present study, the is to estimate the role of high resolution computed tomography (HRCT) in early detection of pulmonary involvement in SLE patients.

Subjects and Methods

The study population consisted of fifty (٥٠) female patients with SLE were taken from Internal medicine and Rheumatology department in Minia university hospital from august ٢٠٠٨ to September ٢٠١١, their main age was ٢٤.٢ years ± ٧.٤ and their main disease duration was ٢٨.٤ months ± ٢٤.٦٥.

Detailed history regarding cough (with or without expectoration), respiratory difficulty, chest pain and hemoptysis was recorded in a performed Performa.

All patients have no or mild respiratory symptoms at the time of study in the form of cough, dyspnea and chest pain. Patients were excluded if they were known to have interstitial lung disease (occupational hazard) or pregnant..

High-resolution CT (HRCT) of the chest:

All CT were performed on CT GENERAL ELECTRIC PROSPEED VER ٢٠.٤.٠٠ with following scan protocol: supine scan routine, ٣-٥ section were performed on the lung apices, mid as well as lower lung zones and additional scans in the area of focal abnormalities as seen in the plain x-ray, ١٢٠ Kv and ٢٠٠ mA, Slice thickness١ mm; on performing HRCT of the lung to detect diffuse parenchymal lesion or interstitial disease its not necessary to inject contrast medium.

The following CT signs were evaluated:

Pulmonary parenchymal nodules with or without, calcifications, Linear opacities, increased lung density (Ground glass opacities or Consolidation), Honey combing, Pleural thickening.

Statistical analysis

Data were coded, entered and analyzed by Statistical package for the social sciences (SPSS for windows version ١٣)[١٠]. Two-tailed tests were used throughout and Statistical significance was set at the conventional level of less than ٠.٠٥.

Results

This study was carried out on ٥٠ SLE female patients fulfilling the updated ACR classify-cation criteria for SLE[١١], ٢٤ of them with pulmonary manifestation and ٢٦ of them with-out pulmonary manifestation.

Table (١,٢,٣) summarize the demographic, prominent general features of disease manife-stations and laboratory data of our SLE patients. All our cases were non-smoker and there were no history of occupational exposure.

The symptoms referable to respiratory system were present mostly cough in ٢٦ (٥٢٪) patients, followed by exertional dyspnea in ٢٦(٥٢٪) patients most of them in grade ١١ to ١١١ (according to American thoracic society score "ATS"), chest pain in ١٨ (٣٦٪) patients.

Imaging findings in SLE patients:

- Chest radiography:

Table (٤) show findings of CXR in patients with +ve pulmonary symptoms and patients without pulmonary symptoms it shows normal CXR in ٢٨(٥٦٪) half of them are symptomatic and half asymptomatic patients. Pleural disease in ٦(١٢٪), ILD in ٤(٨٪) patients. Airway disease in ٦(١٢٪). Pneumonia in ٢(٤٪) patients. Cardiomegally in ١٠(٢٠٪) patients. Pulmonary artery dilatation in ٤(٨٪) patients.

- High resolution computed tomography:

Table (٥) show finding of HRCT in patients with +ve clinically pulmonary findings (symp-tomatic) and patients without clinically pulmo-nary findings (asymptomatic), it show normal HRCT in ١٨(٣٦٪) patients. Pleural disease in ١٤(٢٨٪) and ٨ patient ILD in ٢٦(٥٦ patients. Airway disease in ٢(٤٪) patients. Pneumonia in ٨(١٦٪) patients. Table (٦) Show comparison between CXR and HRCT findings in all group studies, there is a significant difference in normal findings, pleural disease findings, and highly significant differences in ILD.

Table ١: Demographic data of the studied patients

		Patients
Age (years)	**Range**	١٥-٥١
	Mean±SD	٢٤.٢±٧.٤
Disease duration (months)	**Range**	٢-١٢٠
	Mean±SD	٢٨.٤±٢٤.٦٥
Sex (n=٥٠)	**Females (n,%)**	٥٠ (١٠٠٪)

Table ٢: Clinical data of the studied patients (Total ٥٠ females)

Clinical manifestation	Positive No. (%)	Negative No. (%)
Chest and cardiovascular manifestation		
Cough + expectoration	٢٦ (٥٢٪)	٢٤ (٤٨٪)
heamoptysis	١٠ (٢٠٪)	٤٠ (٨٠٪)
dyspnea	GI ٤ (٨٪) GII ١٢ (٢٤٪) GIII ١٠ (٢٠٪)	٢٤ (٤٨٪)
wheezes	٤ (٨٪)	٤٦ (٩٢٪)
Toxic manifestation	٢٤ (٤٨٪)	٢٦ (٥٢٪)
Chest pain	١٨ (٣٦%)	٣٢ (٦٤٪)
Mucocutaneous manifestation:		
Skin	١٨ (٣٦٪)	٣٢ (٦٤٪)
Ulcer	١٦ (٣٢٪)	٣٤ (٦٨٪)
Alopecia	٢٨ (٥٦٪)	٢٢ (٤٤٪)
photosensitivity	١٦ (٣٢٪)	٣٤ (٦٨٪)
Musculoskeletal manifestation		
arthritis	٤ (٨٪)	٤٦ (٩٢٪)
arthralgia	٣٠ (٦٠٪)	٢٠ (٤٠٪)
Vasculitis		
Raynouds phenomenon	٨ (١٦٪)	٤٢ (٨٤٪)
Palpable purpra	٢٠ (٤٠٪)	٣٠ (٦٠٪)
Bleeding tendency	١٠ (٢٠٪)	٤٠ (٨٠٪)
Abortion	٤ (٨٪)	٢٤ (٤٨٪)

Table ٣: Laboratory data of the studied patients

	Positive No (%)	Negative No (%)
ANA	٣٦ (٧٢٪)	١٤ (٢٨٪)
CRP	٤٤ (٨٨٪)	٦ (١٢٪)
Antds DNA (Iu/ml)	٣٦ (٧٢٪)	١٤ (٢٨٪)
C٣ (mg/dl)	٣٧ (٧٤٪) *	١٣ (٢٦٪) **
C٤ (mg/dl)	٣٦ (٧٢٪) *	١٤ (٢٨٪) **
protein\٢٤ hours(gm)	٣٢ (٦٤٪)	١٨ (٣٦٪)
	Range	**Mean±SD**
HB	٧.٣-١٣	١٠.٣±١.٦٤
Platelets	٥٤-٥٢٦	٢٦٣.٢±٩٤.٧٤
RBCS	١.٦-٥	٤.٠٧±٠.٧٥
Retics	٠.٤-٢.١	٠.٧±٠.٣٩
WBCS	٢.٤-٣١.٢	٧.٥±٦.٧٦
ESR(١ST hour)	١٠-١٣٠	٥٧.٦±٤١.٥
ESR(٢nd hour)	٢٧-١٤٠	٨٧.٨±٣٨.٨٤

***** hypocomplementemia,
*** *** Normal complement level

Table ٤: X-ray findings in patients with clinically pulmonary findings (symptomatic) and those without clinically pulmonary findings (asymptomatic patients)

x-ray	Symptomatic No = (٢٤)	Asymptomatic No = (٢٦)	Total No = (٥٠)
Normal	١٤ (٥٨٪)	١٤ (٥٤٪)	٢٨ (٥٦٪)
Pleural disease : **pleural effusion unilateral** **Bilateral** **Total**	 ٢ ٠ ٢ (٨٪)	 ٣ ١ ٤ (١٥٪)	 ٦ (١٢٪)
ILD: **Increase reticular pattern**	 ٤ (١٧٪)	 ٠(٠٪)	 ٤ (٨٪)
Air way disease: **Increase bronchovascular markings**	 ٢ (٨٪)	 ٤ (١٥٪)	 ٦ (١٢٪)
Pneumonia: **Patches of opacity**	 ٢ (٨٪)	 ٠ (٠٪)	 ٢ (٤٪)
Cardiomegaly	٤ (١٧٪)	٦ (٢٣٪)	١٠ (٢٠٪)
Pulmonary artery dilatation	٢ (٨٪)	٢ (٨٪)	٤ (٨٪)

Table ٥: HRCT findings in patients with clinically pulmonary findings (symptomatic) and those without clinically pulmonary findin (asymptomatic patients)

HRCT	Symptomatic No = (٢٤)	Asymptomatic No = (٢٦)	Total No = (٥٠)
Normal	١٠ (٤٨٪)	٨ (٣١٪)	١٨ (٣٦٪)
Pleural disease :			
١-pleural effusion	٢	٤	
٢- Pleural thickening	٢	٢	
٣- Subpleural band	٢	٢	
Total	٦ (٢٥٪)	٨ (٣١٪)	١٤ (٢٨٪)
ILD:			
١-interstitial thickening	٢	٠	
٢- Parenchymal band	٢	٢	
٣- Parenchymal nodules	٢	٠	
٤-Thick Inter-lobular septa	٦	٢	
٥-Ground glass appearance	٤	٠	
٦- thick fissure	٤	٢	
Total	٢٠ (٨٣٪)	٦ (٢٣٪)	٢٦ (٥٢٪)
Air way disease:			
thick bronchial wall	٠ (٠٪)	٢ (٨٪)	٢ (٤٪)
Pneumonia:			
Air space consolidation	٤ (١٧٪)	٤ (١٥٪)	٨ (١٦٪)

Table ٦: Comparison between x-ray findings and HRCT in all studied patients

Finding	X Ray Total=٥٠	HRCT Total=٥٠	p
Normal	٢٨	١٨	٠.٠٢*
Pleural disease	٦	١٤	٠.٠٢*
ILD	٤	٢٦	٠.٠٠٠٠٧***
Airway Disease	٦	٢	٠.٠٧
pneumonia	٢	٨	٠.٠٤

* significant P-value < ٠.٠٥
** significant P-value < ٠.٠١
*** significant P-value < ٠.٠٠١

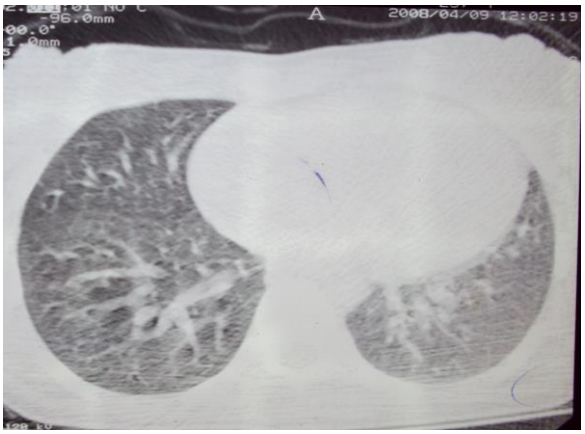
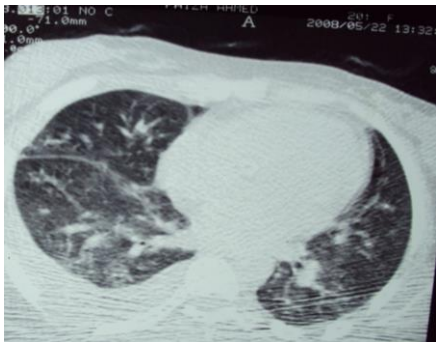
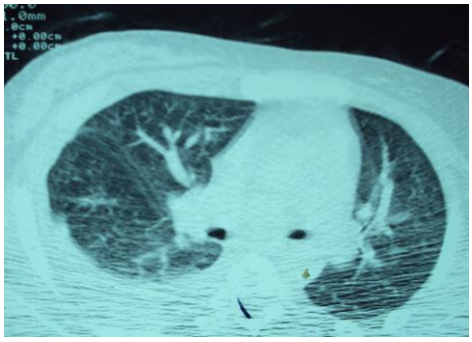


Image. ١: Female patient ٢٥y with SLE. Axial HRCT of the chest showing increased lung transradiancy with diffuse fine granular pattern (ground glass appearance)





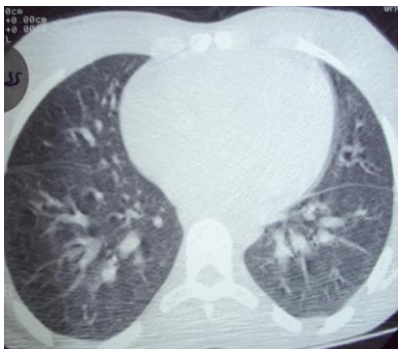


Image. ٢: Female patient ٢٠y with SLE. Axial HRCT of the chest showing right plural effusion, thickened bronchila wall, thickened fissure

Discussion

The prevalence of respiratory manifestations in patients with systemic lupus erythematosus (SLE) varies depending on several factors, including methods of diagnosis, time of follow-up[١٢]. In the study of Miriam et al.,[١٣] ٧ female patients and one male patient presented clinically with dyspnea on exertion (٥٠٪). And non-productive cough (٢٥٪). Two patients were asymptomatic, another two had bibasilar rales.

In the present study, the symptoms referable to respiratory system were present cough, and exertional dyspnea in ٢٦(٥٢٪) patients, chest pain in ١٨(٣٦٪) patients, heamoptysis in ١٠(٢٠٪) and wheezes in ٤(٨٪)

In the present study show normal HRCT in (٣٦٪) and more than half of patients (٦٤٪) show abnormal HRCT findings in the study groups patients but present in ٨٤.٢٪ in the study of Bukhary et al.,[١٤] in ٣٨٪ in the study of Bankier et al.,[١٥] ٧٠٪, in Fenlon et al.,[١٦] ٧٨٪ in Anwar S et al.,[١٧] ٥٥.٢٦٪ in Kakati et al.,[١٨] ٧٢٪ in Sant et al.,[١٩] and ٦٠٪ in Ooi et al.,[٢٠] .

In the present study, more than half of patients show interstitial pattern ٢٦(٥٢٪) followed by, pleural disease in١٤(٢٨٪), pneumonia ٨(١٦٪) airway disease ٢(٤٪), cardiomegally ٨(١٦٪) and pericardial effusion ٤(٨٪).

The present study in agreement with the study of Jeffery et al.,[٢١] which found that ILD are present in at least a third of asymptomatic subjects and airway abnormalities are seen in one fifth. In contrast to the study of Kakati et al.,[١٨] which state that ILD in ٣٩.٤٧٪ but Orens et al.,[٢٢] detect ILD in ٦٪ only of patients while Fenlon et al.,[١٦] was report ILD in ٥٣٪ of patients on HRCT and ٣٣٪ had a definitive diagnosis of ILD. In the study of Ghosh et al., Interstitial lung disease (ILD) was found in ١٠٪ of cases[٢٣]. While study of Anwar S et al.,[١٧] state that HRCT finding of ILD in ٣٧.٥٪, interalveolar hemorrhage in ٢٥٪, pneumonia in ١٥.٦٢٪.

Comparison between chest X-ray and HRCT findings in all group in our study show ٣٢(٦٤٪) patients show abnormality in HRCT compared with ٢٢(٤٤٪) patients on plain chest x-ray, while in the study of Anwar S et al.,[١٧] there is HRCT abnormality in ٢٥ patients (٧٨.١٢٪) compared with ٨ patients (٢٤.٩٧٪). High resonance CT was found to be more sensitive to diagnose ILD, as in ٥٠٪ of ILDs diagnosed by scan, chest x-rays were normal[٢٣].

In the present study In comparison of HRCT in asymptomatic and symptomatic patients, out of ٢٦ patients who were asymptomatic and had normal clinical examination ٢٠(٧٧٪) patients had HRCT abnormalities. in the study of Kakati et al.,[١٨] out of ٣٨ patients, ١٢(٣١٪) patients had clinical features suggestive of pulmonary involvement, chest x-ray, PFT abnormalities. Of ٢٦ patients who were asymptomatic had a normal examination, normal chest x-ray and normal PFT, ١٠ patients had HRCT abnormalities.

In the present study ٤٪ of patients showing airway affection in the form of Bronchial wall thickening and bronchiectasis on chest HRCT were In the study of Fenlon et al.,[١٦] detected in approximately ٢٠٪ of lupus patients, but they are commonly clinically silent. Bronchiolar disorders in lupus are rare, this study show higher percentage than our study .

References

١- Kamen DL and Strange C, Pulmonary manife-stations of systemic lupus erythematosus. Clin Chest Med. ٢٠١٠; ٣١(٣):٤٧٩-٨٨.

٢- Hochberg MC. Updating the American College of Rheumatology revised criteria for the classification of systemic lupus erythematosus. (Letter) Arthritis Rheum. ١٩٩٧; ٤٠(٩):١٧٢٥.

٣- Wakeland EK, Liu K, Graham RR and Behrens TW. Delineating the genetic basis of systemic lupus erythematosus. Immunity. ٢٠٠١; ١٥: ٣٩٧-٤٠٨.

٤- Nath SK, Kilpatrick J and Harley JB. Genetics of human systemic lupus erythematosus: the emerging picture. Curr Opin Immunol. ٢٠٠٤;١٦:٧٩٤-٨٠٠.

٥- Malaviya A.N. et al: Systemic lupus erythematosus in India. Lupus. ١٩٩٧;٦:٦٩٠-٧٠٠.

٦- Jonathan B. Orens, Fernando J. Martinez, Joseph P and Lynch I. Pleuropulmonary manifesttations of systemic lupus erythematosus: Rheumatic Disease Clinics of North America. ١٩٩٤; ١٥٩-١٩٣.

٧- Mathieson JR, Mayo JR and staples CA.: Chronic diffuse infiltrative lung disease:

comparison of diagnostic accuracy of CT and chest radiography. Radiology. ١٩٨٩; ١٧١:١١١-١١٦

٨- Muller ML and Miller RR: Computed tomography of chronic diffuse infiltrative lung disease (Part ١); Am Rev Respir Dis. ١٩٩١;١٤٢(١٢٠٦):١٥١-٩٩٠

٩- Saito Y, Tereda M, Takada M, Ishida T, Moriyama H, Oo H. et al.,. Pulmonary involvement in mixed connective tissue disease: comparison with other collagen vascular disease using HRCT. L. comupt. Assist. tomogr. ٢٠٠٢;٢٦:٣٤٩-٥٧

١٠- (SPSS) Statistical Package for the social Sciences, Inc., ٢٠٠٠

١١- Hochberg MC. Updating the American College of Rheumatology revised criteria for the classification of systemic lupus erythematosus [Letter]. Arthritis Rheum. ١٩٩٨;٤٠:١٧٢٥

١٢- Pego-Reigosa J, Medeiros D and Isenberg D. Respiratory manifest-tations of systemic lupus erythematosus: old and new concepts Best Practice and Research.Clinical Rheumatology. ٢٠٠٩;٢٣:٤٦٩–٤٨٠.

١٣- Miriam B, Buenviaje MD, Sandre TG, et al.,: Pulmonart manifestations of systemic lupus erythrematosus. Phil J. Internal Medcine. ١٩٩٤;٣٢:١٨-٢٢.

١٤- Bukhary FS, Mohsen AM, Ramadan SM, El-Sharkawy and Osman KS. Assessment of respiratory functions in lupus patients, Clinico-pathological studies matched by HRCT. Egyptian journal of chest diseases and tuberculosis. ١٩٩٩;٤٨(١):٣٩-٥٢.

١٥- Bankier AA, Kienner HP, Weismayer MN, Fleishmann DS, Kontrus MA, Herold CJ,

involvement in SLE, CT assessment. Radiology. ١٩٩٥; ١٩:٨٣٥-٤٠.

١٦- Fenlon HM, Doran M, Sant SM and Breatnach E. High resolution chest CT in systemic lupus erythematosus. American Journal of Roentgenology. ١٩٩٦;١٦٦:٣٠١-٧.

١٧- Anwar S, Adly M, Behairy N and Halim M. HRCT chest findings in SLE patients with pulmonary manifestations. The Egyptian Rheumatologist. ٢٠٠٧; ٢٩(٢):٦١٩-٦٣٤.

١٨- Kakati, Doley, Dihingia, Pegu, Pal and Deka A. clinical study of pulmonary manifestations in systemic lupus erythematosus with special reference to CT findings. Indian Journal of Rheumatology. ٢٠٠٧; ٤(٢):١٣٣-١٣٦.

١٩- Sant SM, Doran M, Fenelon HM and Breatnach ES. Pleuropulmonary abnormalities in patients with SLE: assessment with HRCT, chest x-ray and pulmonary function tests. Clin Exp Rheumatol. ١٩٩٧;١٥(٥):٥٠٧-١٣.

٢٠- Ooi GC, Ngan H, Peh WCG and Mok MY. Clinical radiology. ١٩٩٧;٥٢:٧٧٥-٨١.

٢١- Jeffrey J, Swigris, Aryeh Fisher, Joann Gilles, Richard T, Meehan and Kevin K. Pulmonary and thrombotic manifestations of SLE. Chest. ٢٠٠٨; ١-١٧.

٢٢- Orens JB, Martinez FJ and Lynch JR. Pleuropul-monary manifestatioi systemic lupus erythematosus. Rheum Dis Clin North Am. ١٩٩٤;٢٠:١٥٩.

٢٣- Ghosh A, Das T, Ghosh A, Karmakar P and Pal J. Evaluation of respiratory manifestations in systemic lupus erythematosus with special reference to pulmonary interstitial involvement. J Indian Med Assoc. ٢٠١٢;١١٠(٢):١٠٩-١١.

Craninger W and Hubsch P. Discrete lung