

Role of High Resolution Computed Tomography (HRCT) in the Evaluation of Diffuse Lung Disease

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ABSTRACT

Objective: To determine the accuracy of High Resolution Computed Tomography in the evaluation of Diffuse interstitial lung disease.

Study Design: Descriptive study.

Place and Duration of Study: This study was conducted in the Department of Diagnostic Radiology, Pakistan Institute of Medical Sciences, Islamabad during the year June 2008 to December 2008.

Materials and Methods: 30 patients were selected from OPD and Emergency department with history, clinical signs and plain chest radiograph suggestive of diffuse lung disease. Multi-slice high resolution spiral CT scanner "Asteion VR" (Toshiba) was used to conduct the study with High Resolution Computed Tomography (HRCT) protocol used in the evaluation of diffuse lung disease.

Results: The 30 patients included in this study comprised of 15 male and 15 females with a male to female ratio of 1:1. The mean age of patients was 50.33 years. Cough was present in 100% of patients, dyspnea (83%), hemoptysis (17%), body aches (43%), joint pains (13%), and occupational exposure (23%). Different clinical signs were wheezing (70%), coarse crepitation's (47%) and clubbing (7%). In this study of all 30 patients (n=30) sarcoidosis was (23%), pneumoconiosis (27%), idiopathic pulmonary fibrosis (20%), extrinsic allergic alveolitis (7%), lymphangitic carcinomatosa (10%) and systemic sclerosis (3%). Normal or non-diagnostic chest X-rays were seen in 20% patients which were then diagnosed by HRCT. The inter observer agreement on chest X-rays was found to be around 27% and that of HRCT is 52%.

Conclusion: HRCT is the diagnostic tool of choice in the diagnosis of diffuse interstitial lung disease.

Key Words: High Resolution Computed Tomography, Evaluation, Diffuse Lung Disease

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INTRODUCTION

The chest radiograph remains the first imaging modality for the approach to diffuse infiltrative lung disease (DILD), but, 23 years after its introduction, high-resolution CT (HRCT) is still considered the best imaging tool for the evaluation of the pulmonary interstitium and to diagnose and assess DILD. The introduction of multidetector computed tomography (MDCT) has provided the thoracic radiologist with a powerful tool with which to image the lung. Moreover MDCT has enabled radiologists to understand better the functional information contained within CT images of DILD.¹ Interstitial lung diseases (ILDs) encompass a wide range of diffuse pulmonary disorders, characterized by a variable degree of inflammatory and fibrotic changes of the alveolar wall and eventually the distal bronchiolar airspaces.² The idiopathic interstitial pneumonias are diffuse lung diseases characterized by

interstitial inflammation and fibrosis. High resolution computed tomography (HRCT) is the best imaging technique for the study of interstitial disease. The general term "idiopathic interstitial pneumonia" includes usual interstitial pneumonia/idiopathic pulmonary fibrosis, nonspecific interstitial pneumonia, desquamative interstitial pneumonia, respiratory bronchiolitis-associated interstitial lung disease, cryptogenic organizing pneumonia, acute interstitial pneumonia, and lymphocytic interstitial pneumonia.³ Various HRCT findings, taken together, can represent typical patterns. These patterns, in conjunction with the anatomical distribution of findings and with clinical data, can narrow the differential diagnosis of diffuse interstitial lung disease and, in many cases, indicate the correct diagnosis with a high degree of accuracy.⁴⁻⁶ The widespread use of HRCT has been stimulated by numerous published series, which have evaluated the accuracy of HRCT in cohorts of patients.⁷

MATERIALS AND METHODS

This is a descriptive study which included thirty patients. The study was conducted in the Department of Diagnostic Radiology, Pakistan Institute of Medical

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Sciences, Islamabad during the year June 2008 to December 2008. The patients were selected from OPD and Emergency department with history, clinical signs and plain chest radiograph suggestive of diffuse lung disease. The patients with clinical signs and history of occupational exposure with a normal/non-diagnostic chest radiograph. Multi-slice high resolution spiral CT scanner "Asteion VR" (Toshiba) was used to conduct the study with High Resolution Computed Tomography (HRCT) protocol used in the evaluation of diffuse lung disease. The essential features of HRCT include the use of thin collimation of 2mm slices with pitch 1.0 and reconstruction interval of 2-mm data reconstructed with FC 30 bone algorithm or high spatial resolution. High spatial resolution resulted in increased image sharpness with window width of 600 and window length of 1500 HU. For HRCT no specific patient preparation or intravenous contrast was needed. High resolution CT was typically obtained in suspended full inspiration and in the supine position at preselected levels such as aortic arch, tracheal carina, and extreme lung bases. When needed prone images were taken. When needed prone images were taken. HR protocol was used for confirmation of abnormality in patients with symptoms suggestive of diffuse lung disease with a normal or near normal chest radiograph, while further assessment was done in patients with an abnormal but non diagnostic chest radiograph. The signs that indicate the presence of diffuse lung disease on HRCT include the presence of thickened interlobular septa, irregular linear attenuation, cystic air spaces, small nodules, ground glass attenuation and parenchymal consolidation.

RESULTS

The 30 patients included in this study comprised of 15 male and 15 females with a male to female ratio of 1:1. The distribution of patients according to age and mean age of patients was 50.33 years (Table 1). Cough was present in 100% of patients, dyspnea (83.3%), hemoptysis (16.6%), body aches (43.3%), joint pains (13.3%), and occupational exposure (23%). Different clinical signs were wheezing (70%), coarse crepitation's (46.7%) and clubbing (6.7%) (Table 2).

Table No.1: Age distribution of patients

Age (years)	No.	%age
1 – 20	3	10.0
21 – 40	5	16.6
41 – 60	11	36.7
61 – 80	11	36.7

In this study of all 30 patients (n = 30) sarcoidosis was (23.3%), pneumoconiosis (26.7%), idiopathic pulmonary fibrosis (20%), extrinsic allergic alveolitis (6.7%), lymphangitic carcinomatosa (10%) and systemic sclerosis (13.3%) (Table 3). In this study of 30 patients, normal or non-diagnostic chest X-rays were seen in 6 patients (20%) which were then diagnosed by

HRCT. The inter observer agreement on chest X-rays was found to be around 27% and that of HRCT is 52%.

Table No.2: Frequency of symptoms and signs

Signs/Symptoms	No.	%age
Cough	30	100.0
Dyspnea	25	83.3
Hemoptysis	5	16.6
Body aches	13	43.3
Joint Pains	4	13.3
Wheezing	21	70.0
Coarse Crepitation	14	46.7
Clubbing	2	6.7

Table No.3: Frequencies of different diseases

Disease	No.	%age
Pneumoconiosis	8	26.7
Sarcoidosis	7	23.3
Idiopathic pulmonary fibrosis	6	20.0
Acute interstitial pneumonia	2	6.7
Extrinsic allergic alveolitis	3	10.0
Lymphangitis carcinomatosa	3	10.0
Systemic sclerosis	4	13.3

DISCUSSION

The mean age of the patients was 50.33 years, with no gender bias which is consistent with international studies.⁸⁻¹⁰ However an Iranian study showed a slight younger drift in age.⁸ A study from Kuwait showed that 80% of patients were above 40 years of age.¹¹ The mean age was 59±11 years in a Turkish study.¹² Workers from Spain found that the mean age of the patients was 61±0.7 years and the male to female ratio was 1.2:1.¹³ In India Meheshwari and others found the mean age to be 50.6±11.9 years.¹⁴ This study found cough to be a universal symptom and this is consistent with other international studies.^{8,14} Dyspnea was a prominent symptom and this has been described by other workers in Netherland¹⁵ and Iran.⁸ Our study showed hemoptysis in only 17% of patients while other workers have showed it to be 54%¹⁶ and 4%.¹⁷ However these studies were conducted in children and our study included only adults. The frequency of arthralgia in our study was lower than described in other study conducted in Jordan¹⁸, but that study had predominant population of inflammatory myopathies. Occupational exposure has been described as a major factor in diffuse pulmonary disease^{19,20} but our study only had a minority of patients with occupational exposure, this was because it was conducted in a tertiary care hospital which drained myriad groups of affected patients. Wheezing which may suggest small airways involvement was present in the majority of patients.²¹ Crepitation's were found in almost half of the patients which is less than other studies conducted in the region.⁸ Our frequency of clubbing was also less

than found by workers in Iran⁸ but that study was mainly focused on idiopathic pulmonary fibrosis. Our study showed the predominance of Pneumoconiosis which consistent with other studies conducted around the globe.^{22,23} We found the frequency of Sarcoidosis second to pneumoconiosis. In a study in France Sarcoidosis was forth in frequency following idiopathic fibrosis, asbestosis and silicosis.²⁴ HRCT is the study of choice for the diagnosis of this condition for the last twenty years.²⁵ Indian workers found that idiopathic pulmonary fibrosis, Sarcoidosis, interstitial lung disease secondary to collagen vascular disease and extrinsic allergic alveolitis, among others, were the most common etiological causes of interstitial lung disease.²⁶ Our study found interstitial fibrosis third in frequency, the differences cannot be explained and more studies are needed to determine this. Our study also found extrinsic allergic alveolitis to be an etiologic entity and this is collaborated by other studies.^{26,27} Italian workers have shown the diagnostic role of HRCT in assessing and confirming the extent of lung damage in systemic sclerosis.²⁸ Our study also highlights systemic sclerosis as one of the main etiologic factors in diffuse lung disease. Lymphangitic carcinomatosa was also found to be an important etiologic factor in this study and this is consistent with other international studies.^{24,29} High-resolution computed tomography was confirmed to be superior to conventional radiography in the accurate diagnosis of diffuse interstitial lung disease in clinical practice and this is consistent with other international studies.²⁵ Some studies show that it has obviated the need for lung biopsy in many conditions.⁶ HRCT is a useful investigative method both for diagnosing diffuse infiltrative pulmonary disease as well as in following up the effectiveness of treatment.³⁰ Chest radiography is the initial tool for diagnosis, HRCT can provide routine visualization of structures of less than 500 μ m. HRCT can be useful in formulating a differential diagnosis with recognition of pattern and distribution of the disease.³¹

CONCLUSION

HRCT is the diagnostic tool of choice in the diagnosis of diffuse interstitial lung disease.

REFERENCES

1. Zompatori M, Sverzellati N, Poletti V, Bna C, Ormitti F, Spaggiari E, et al. High-resolution CT in diagnosis of diffuse infiltrative lung disease. *Semin Ultrasound CT MR* 2005;26(5):332-47.
2. Behr J. Approach to the diagnosis of interstitial lung disease. *Clin Chest Med* 2012;33(1):1-10.
3. Franquet T, Gimenez A. Idiopathic interstitial pneumonias. *Radiologia* 2012;54(6):479-89.
4. Elicker B, Pereira CA, Webb R, Leslie KO. High-resolution computed tomography patterns of diffuse interstitial lung disease with clinical and pathological correlation. *J Bras Pneumol* 2008;34(9):715-44.
5. Sharma S, Maycher B. Is HRCT the best way to diagnose idiopathic interstitial fibrosis? *Curr Opin Pulm Med* 2006;12(5):323-30.
6. Diette GB, Scatarige JC, Haponik EF, Merriman B, Fishman EK. Do high-resolution CT findings of usual interstitial pneumonitis obviate lung biopsy? Views of pulmonologists. *Respiration* 2005;72(2):134-41.
7. Wells AU. High-resolution computed tomography in the diagnosis of diffuse lung disease: a clinical perspective. *Semin Respir Crit Care Med* 2003;24(4):347-56.
8. Hashemi Sadraei N, Riahi T, Masjedi MR. Idiopathic pulmonary fibrosis in a referral center in Iran: are patients developing the disease at a younger age? *Arch Iranian Med* 2013;16(3):177-81.
9. Volpinari S, La Corte R, Bighi S, Ravenna F, Prandini N, Lo Monaco A, et al. Bronchoalveolar lavage in systemic sclerosis with lung involvement: role and correlations with functional, radiological and scintigraphic parameters. *Rheumatol Int* 2011;31(9):1183-8.
10. Patiwetwitoon S, Wangkaew S, Euathrongchit J, Kasitanon N, Louthrenoo W. High-resolution computed tomographic findings in systemic sclerosis-associated interstitial lung disease: comparison between diffuse and limited systemic sclerosis. *J Clin Rheumatol* 2012;18(5):229-33.
11. Abul A, Onadeko BO, Khadadah ME, Behbehani N, Cerna M, Cherian JM, et al. Clinical patterns of diffuse parenchymal lung disease in Kuwait: a prospective study. *Med Princ Pract* 2004;13(2):78-83.
12. Ozbay B, Uzun K, Arslan H, Zehir I. Functional and radiological impairment in women highly exposed to indoor biomass fuels. *Respirol* 2001;6(3):255-8.
13. Xaubet A, Ancochea J, Morell F, Rodriguez-Arias JM, Villena V, Blanquer R, et al. Report on the incidence of interstitial lung diseases in Spain. *Sarcoidosis Vasc Diffuse Lung Dis* 2004;21(1):64-70.
14. Maheshwari U, Gupta D, Aggarwal AN, Jindal SK. Spectrum and diagnosis of idiopathic pulmonary fibrosis. *Ind J Chest Dis Allied Sci* 2004;46(1):23-6.
15. Westerlaan HE, van der Valk PD. Clinical and radiological evolution in patients with pulmonary Langerhans' cell histiocytosis. *Netherlands J Med* 2002;60(8):320-6.

16. Lu SH, Tan YS, Xu JF, Sujie A, Bai CX, Zhu XZ. Clinicopathologic analysis of pulmonary lymphangioleiomyomatosis. *Zhonghua Jie He He Hu Xi Za Zhi* 2009;32(9):664-9.
17. Bouyahia O, Essadem L, Matoussi N, Gharsallah L, Fitouri Z, Mrad Mazigh S, et al. Etiology and outcome of bronchiectasis in children: a study of 41 patients. *Tunis Med* 2008;86(11):996-9.
18. Mustafa KN, Dahbour SS. Clinical characteristics and outcomes of patients with idiopathic inflammatory myopathies from Jordan 1996-2009. *Clin Rheumatol* 2010;29(12):1381-5.
19. Atis S, Tutluoglu B, Levent E, Ozturk C, Tunaci A, Sahin K, et al. The respiratory effects of occupational polypropylene flock exposure. *Eur Respir J* 2005;25(1):110-7.
20. Dagli CE, Tanrikulu AC, Koksall N, Abakay A, Gelen ME, Demirpolat G, et al. Interstitial lung disease in coppersmiths in high serum copper levels. *Biol Trace Elem Res* 2010;137(1):63-8.
21. Saldias PF, Diaz PO, Gonzalez BS, Osses AR. Bronchiolar disorders: clinical-radiological assessment and classification. *Rev Med Chil* 2011; 139(9):1218-28.
22. Lee KS, Kim TS, Han J, Hwang JH, Yoon JH, Kim Y, et al. Diffuse micronodular lung disease: HRCT and pathologic findings. *J Comput Assist Tomogr* 1999;23(1):99-106.
23. Andreu J, Mauleon S, Pallisa E, Majo J, Martinez-Rodriguez M, Caceres J. Miliary lung disease revisited. *Curr Probl Diagn Radiol* 2002;31(5): 189-97.
24. Vernhet H, Bousquet C, Vergnes C, Thiebault C, Lesnik A, Durand G, et al. Contribution of high-resolution volume computed tomography (HRVCT) for the exploration of diffuse pulmonary infiltrative disorders. *Revue des maladies respir* 1999;16(2):188-97.
25. Nishimura K, Izumi T, Kitaichi M, Nagai S, Itoh H. The diagnostic accuracy of high-resolution computed tomography in diffuse infiltrative lung diseases. *Chest* 1993;104(4):1149-55.
26. Sen T, Udwadia ZF. Retrospective study of interstitial lung disease in a tertiary care centre in India. *Ind J Chest Dis Allied Sci* 2010;52(4): 207-11.
27. Herman M, Kolek V. Diffuse interstitial lung disease -evaluation with high-resolution computed tomography. *Acta Univ Palacki Olomuc Fac Med* 1993;135:25-30.
28. Bellia M, Cannizzaro F, Scichilone N, Riili M, Triolo G, Midiri M, et al. HRCT and scleroderma: semiquantitative evaluation of lung damage and functional abnormalities. *Radiol Med* 2009;114(2): 190-203.
29. Gao Z, Deng X, Cao Z. [Pulmonary lymphangitic carcinomatosis]. *Zhonghua Jie He He Hu Xi Za Zhi* 1998;21(12):739-41.
30. Vajda E, Mester A, Major T, Kiss K, Appel J, Magyar P, et al. High-resolution computer tomography of diffuse infiltrative lung diseases. *Orvosi Hetilap* 1998;139(52):3107-12.
31. Legmann P. Imaging and lung disease: uses and interpretation. *Tuber Lung Dis* 1993;74(3):147-58.