IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 4 Ver. 7 (April. 2018), PP 21-33
www.iosrjournals.org

High Resolution Computed Tomographic Evaluation Of Patients Suspected Of Having Diffuse Interstitial Lung Diseases With Radiographic Correlation.

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Abstract-
Background*- Interstitial lung disease (ILD) consists of a diverse group of disorders that involve the pulmonary parenchyma, Interstitial lung disease may be caused a number of factors such as infections of the lungs; toxins in the environment, certain medications, radiation therapy to the chest, chronic autoimmune diseases: connective tissue diseases.* ***Methods****- Present cross sectional, institutional based study was conducted in Radiology department of RIMS, Ranchi between April 2009 to October 2010. A Pre tested semistructured questionnaire was used for interview of patients which were referred from various department. During study period 35 patients, between age group 20 to 70 years of age having History of dyspnea and chronic cough,History of exposure to organic/inorganic dust, Known case of collagenvascular disease(i.e. rheumatoid arthritis), Abnormal lung function test, Abnormal chest radiograph were interviewed and examined.* ***Results****- Out of 35 patients majority were male (82.9%), age group 41-50 years of age (34.2%),belong to low socio economic status (42.8%), having smoking habit (54.3%), moderate severity of dyspnoea(65.7%).****Conclusion****- HRCT is far superior to a radiograph in detecting changes within the interstitium when chest radiograph is normal.*

Key Words*: Interstitial lung disease, HRCT, Chest radiograph*

Date of Submission: 30-03-2018 Date of acceptance: 15-04-2018

I. Introduction

Interstitial lung disease (ILD) consists of a heterogeneous group of disorders that involve the pulmonary parenchyma, mainly the supporting structures of the lung ie. alveolar walls , interlobular septa and the peribronchovascular interstitium and interfere with gas exchange. These disorders are classified together because of similar clinical, radiographic, physiologic, or pathologic manifestations. Although the term interstitial is used most of these disorders are associated with extensive alteration of alveolar and airway architecture, in addition to changes in the interstitial compartment. For this reason, the terms "diffuse infiltrative lung disease" or "diffuse parenchymal lung disease" are sometimes used. Predominant abnormality is the thickening of interstitium which may be due to accumulation of fluid, fibrosis, cellular infiltration and extracellular matrix deposition.

Interstitial lung disease may be caused a number of factors such as infections of the lungs; toxins in the environment (such as asbestos, silica dust);certain medications (particularly some drugs used as chemotherapy for cancers);radiation therapy to the chest; and chronic autoimmune diseases: connective tissue diseases such as lupus, scleroderma, and rheumatoid arthritis. Sometimes, the process of inflammation and scarring of the interstitial tissues of the lungs develops in the absence of a known cause. When no cause can be identified, this is referred to as idiopathic (unknown cause) interstitial lung disease or idiopathic pulmonary fibrosis.

Incidence of interstitial lung diseases is on the rise due to increase in the level of air-pollution .Increase in number of automobiles and industries are the contributing factors among many others. People are exposed to higher levels or respirable airborne particles than were few years ago.Jharkhand is a mineral rich state. It has one of the biggest coal deposits in India. Other than coal, iron ,mica, bauxite and uranium ore are also found abundantly. Besides, stone crushers can also be seen in peripheral areas catering to the needs of growing infra structures. Workers in these settings are exposed to a wide range of inhalable particulate matter, and are more prone to develop pulmonary diseases such as pneumoconiosis, silicosis etc.

A chest radiograph is usually the first investigation advised to patient with pulmonary symptoms.The chest x- ray correlates poorly with clinical or histopathological stage of the diseases. In most cases, the chest radiograph is non- specific and usually does not allow a specific diagnosis to be made.

High resolution computed tomography (HRCT) is superior to plain chest x-ray for early detection and confirmation of ILD. HRCT can detect anthracotic changes before they appear on radiographs. Thus it can play a crucial role in detection of the disease and monitoring of disease activity in this group of patients. HRCT also allows better assessment of the extent and distribution of diseases, and may be useful in the investigation of patients with normal chest radiograph. Co-existing diseases may also be detected on HRCT ie. Emphysema, carcinoma or adenopathy. HRCT may be sufficiently sensitive to preclude the need of invasive diagnostic procedures such as lung biopsy. When a biopsy is necessary HRCT may be helpful in determining the best area from where the biopsy sample should be obtained.

II. Methods

The present cross sectional, institutional based study was conducted in Radiology department of RIMS, Ranchi between April 2009 to October 2010. A Pre tested semistructured questionnaire was used for interview of patients which were referred from various department. During study period 35 patients, between age group 20 to 70 years of age having History of dyspnea and chronic cough,History of exposure to organic/inorganic dust, Known case of collagenvascular disease(i.e. rheumatoid arthritis), Abnormal lung function test, Abnormal chest radiograph were interviewed and examined.

Patients with acute respiratory tract infection and chronic infection like tuberculosis were excluded from the study. Dyspnea occurring due to renal or cardiac causes was not included in the study. Patients with primary neoplasm were also excluded from the study. Data were entered and analysed in MS Excel. Ethical clearance was taken from ethical committee.

III. Results

For the HRCT examination the Siemens Syngo Somatom 16(forchhiem,germany) apparatus was used, which was equipped with a 512 × 512pixels reconstruction matrix and a special programme for high resolution algorithm image reconstruction.

The width of the examined field was limited to 27 cm. Multiple helical acquisitions (1.25 x 16 detector configuration; 120 kVp; table speed of 8.75 mm/rotation; pitch of 0.875; 0.5-sec scan; and multiple milliampere-seconds ranging between 120 and 300 mAs). Scans of entire chest were obtained in the supine position and images were reconstructed with a high spatial frequency algorithm and photographed at window settings appropriate for viewing the lung parenchyma (window centre -600HU; window width 1200 HU). An additional window for viewing the mediastinal and hila was used (window centre 40HU; window width 400 HU).

TABLE I- showing age wise incidence

Age	Number of cases	Percentage
21-30	2	5.7
31-40	5	22.8
41-50	12	34.2
51-60	10	28.57
61-70	6	17.1

TABLE II- sex wise distribution of disease

Sex	Number	Percentage
Male	29	82.9
Female	6	17.1

TABLE III- Showing incidence according to socio-economic status

Socio-economic status	No. of cases	Percentage
High	8	22.9
Middle	12	34.3
Low	15	42.8

TABLE IV -Showing incidence according to smoking habits

	No. of cases	Percentage
Smokers	19	54.3
Non-smokers	16	45.7

TABLE V-Showing the severity of dyspnoea

Degree	No. of cases	Percentage
Mild	11	31.5
Moderate	23	65.7
Severe	1	2.8

TABLE VI- Showing duration of dyspnoea

duration	No. of cases	Percentage
More than 1 year	23	65.7
Less than 1 year	12	34.3

TABLE VII- Showing presence of cough in the patients

cough	No. of cases	Percentage
Present	25	71.4
Absent	10	28.6

TABLE VIII-Showing presence connective tissue disorder in the patients

connective tissue disorder	No. of cases	Percentage
Present	3	8.5
Absent	32	91.5

TABLE IX- Showing presence clubbing in the patients

clubbing	No. of cases	Percentage
Present	5	14.3
Absent	30	85.7

TABLE X- Showing presence crepitations in the patients

crepitations	No. of cases	Percentage
Present	15	42.8
Absent	20	57.2

TABLE XI- Showing presence of pleural effusion in the patients

pleural effusion	No. of cases	Percentage
Present	5	14.2
Absent	30	85.8

TABLE XII- Showing results of lung function tests(FEV_1/FVC)

(FEV_1/FVC)	No. of cases	Percentage
Normal	13	37.4
Raised	22	62.6

TABLE XIII- Showing blood oxygen saturation

SaO_2	No. of cases	Percentage
Normal	24	68.6
Decreased	11	31.4

TABLE XIV- Showing blood count (for leucocytosis)

Total count WBC	No. of cases	Percentage
Normal	21	60
Raised	14	40

TABLE XV-Showing no. of normal and abnormal chest radiographs

Chest X ray	No. of cases	Percentage
Normal	8	22.8
Abnormal	27	77.2

TABLE XVI- Showing distribution of diffuse shadows on chest X rays

Distribution	No. of cases	Percentage
Predominantly upper lungs	10	37.0
Predominantly lower lungs	5	18.5
nonspecific	12	44.5

TABLE XVII-Showing No. of cases where confident diagnosis was made on chest radiograph alone

Diagnosis	No. of cases	Percentage
confident	19	54.2
equivocal	16	45.8

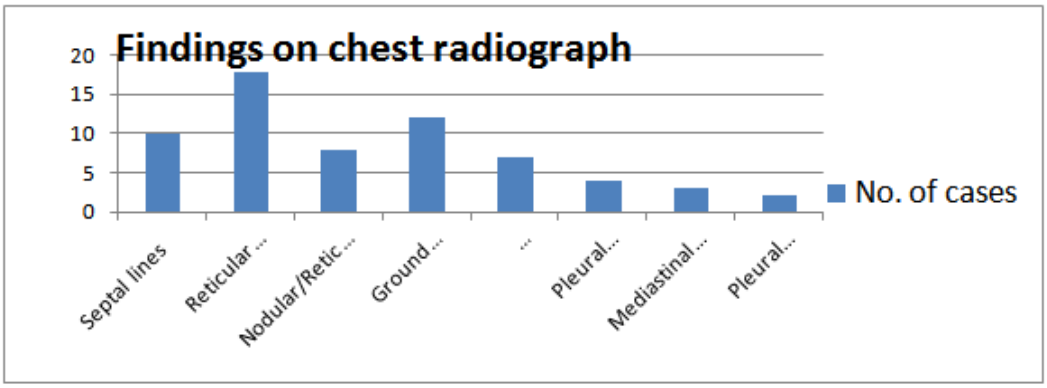
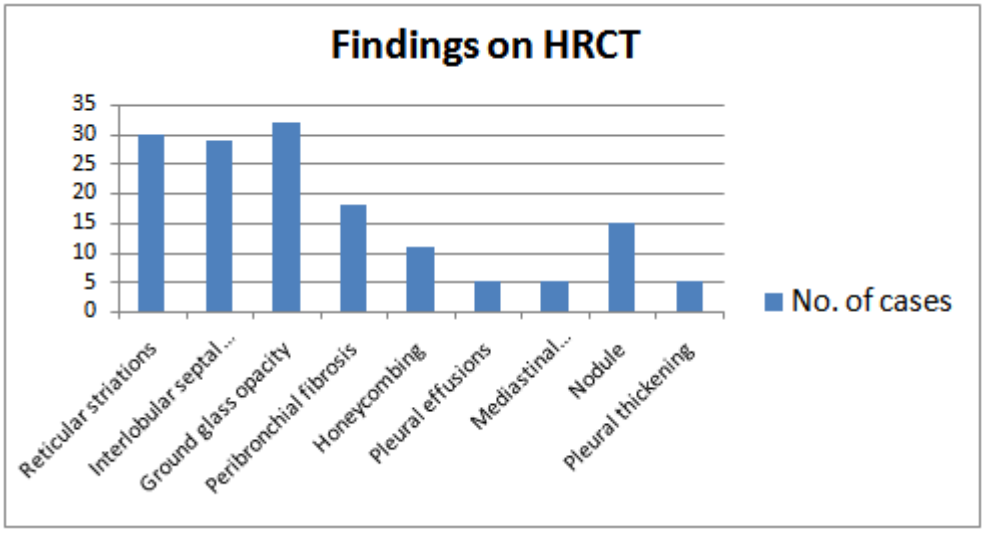


TABLE XVI-Showing chest radiograph findings

Findings	No. of cases	Percentage
Septal lines	10	28.5
Reticular shadows	18	51.4
Nodular/Reticulonodular pattern	8	22.8
Ground glass opacity	12	34.2
Honeycombing	7	20
Pleural effusion	4	11.4
Mediastinal lymphadenopathy	3	8.5
Pleural thickening	2	5.1



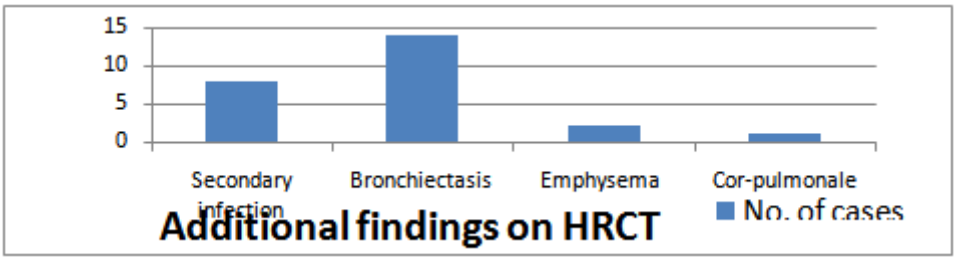
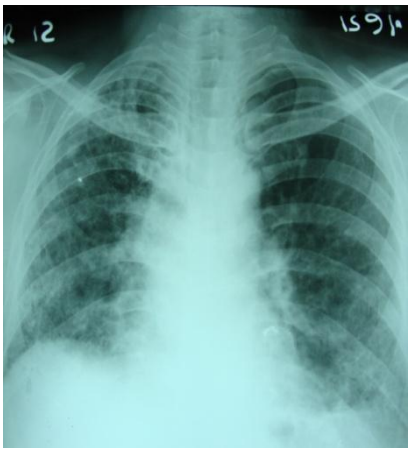


TABLE XVIII-Showing findings on HRCT

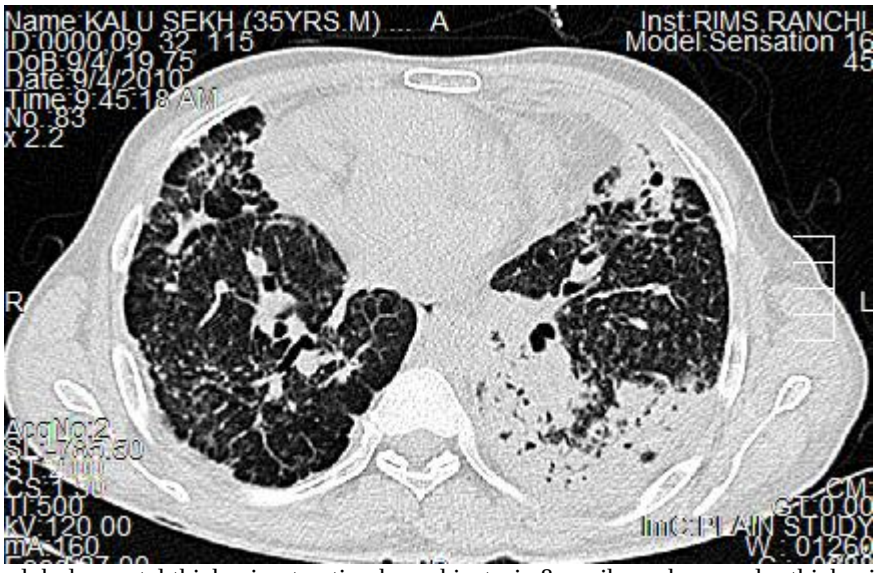
findings	No. of cases	Percentage
Reticular striations	30	85.7
Interlobular septal thickening	29	82.8
Ground glass opacity	32	91.4
Peribronchial fibrosis	18	51.4
Honeycombing	11	31.4
Pleural effusions	5	14.2
Mediastinal lymphadenopathy	5	13
Nodule	15	42.8
Pleural thickening	5	14.2

TABLE XIX-Showing additional findings on HRCT

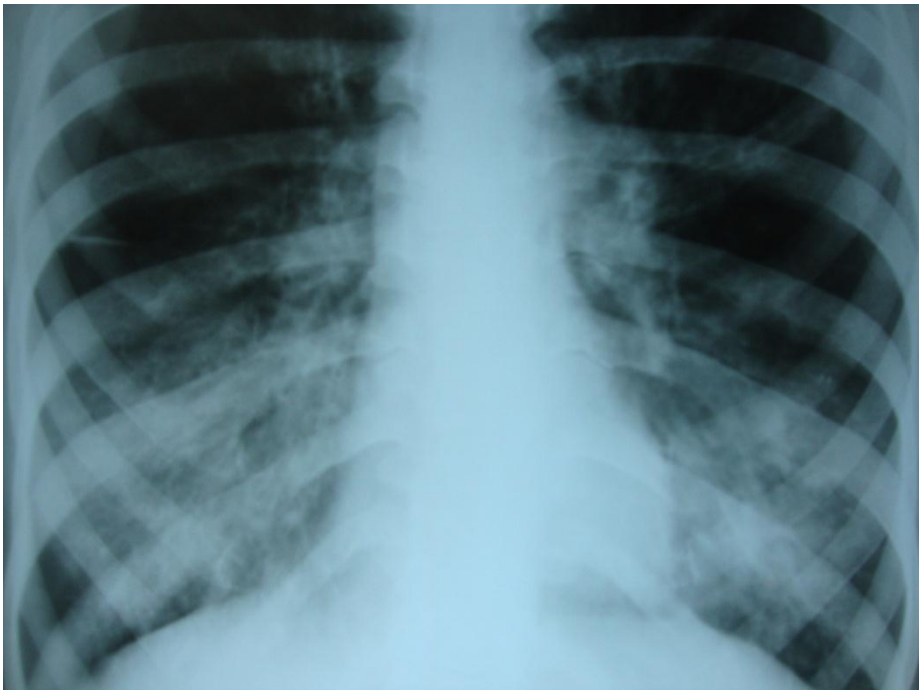
Findings	No. of cases	Percentage
Secondary infection	8	22.8
Bronchiectasis	14	40
Emphysema	2	5.7
Cor-pulmonale	1	2.8



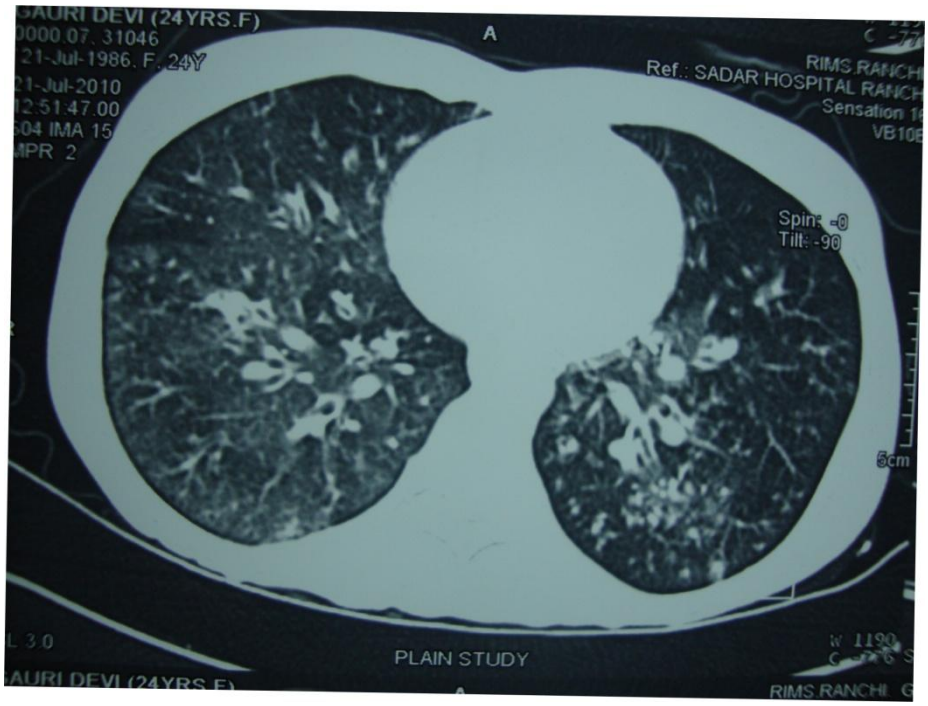
Diffuse bilateral Reticular opacities



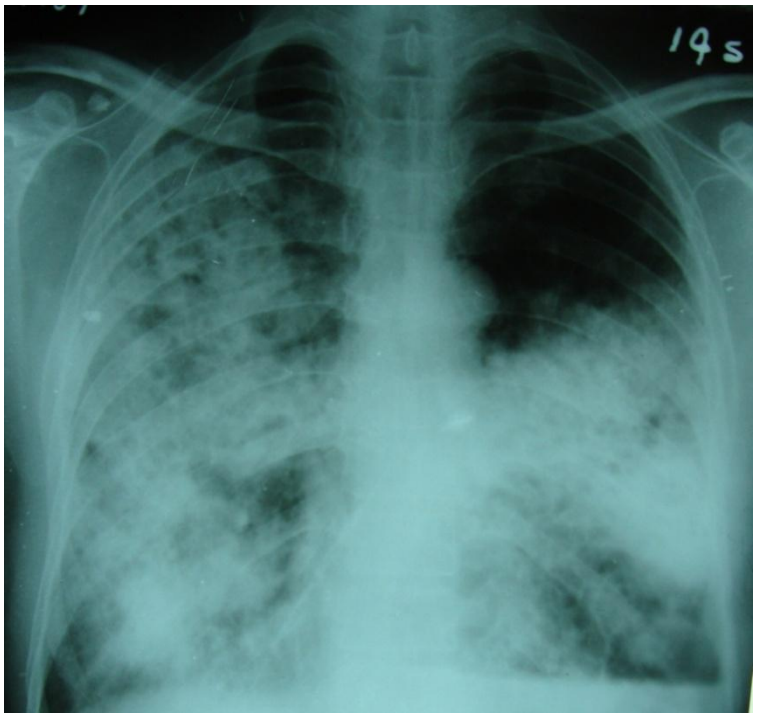
Interlobular septal thickening,traction bronchiectasis & peribronchovascular thickening



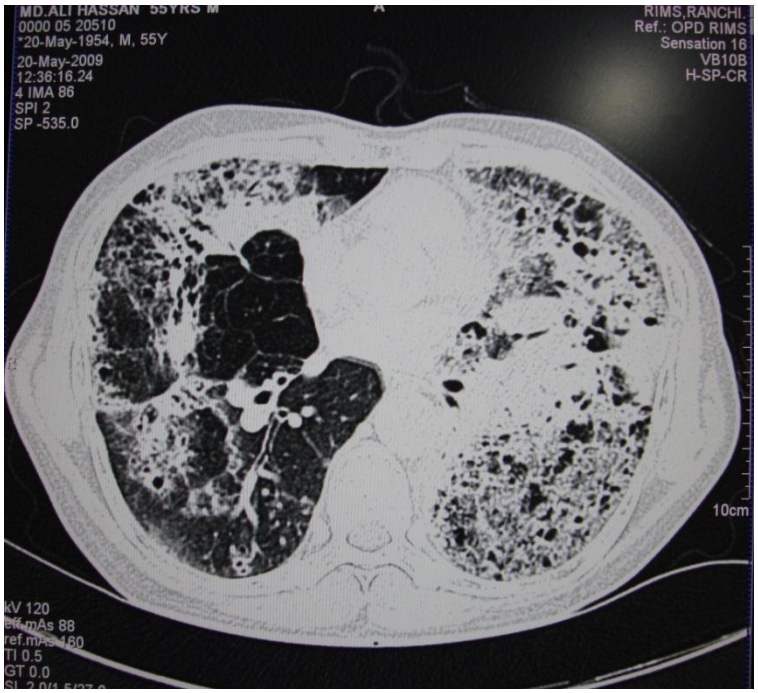
Reticular opacities mainly in basal regions



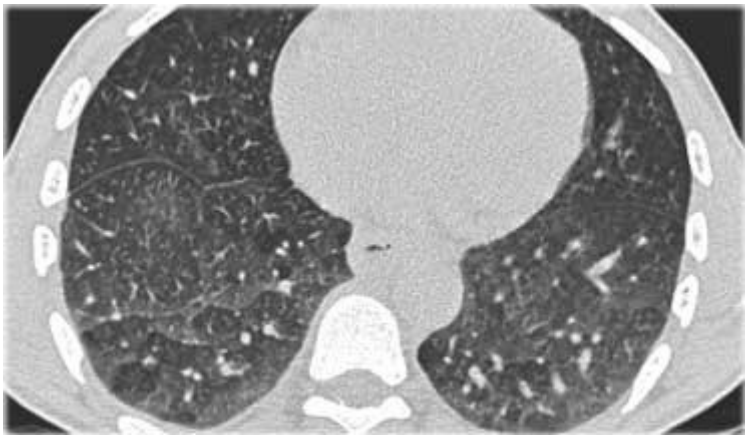
Ground glass opacities with interlobular septal thickening



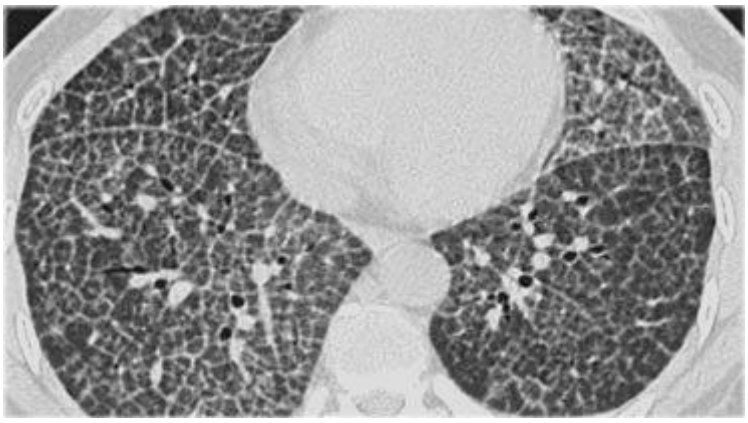
Extensive bilateral reticulonodular opacities



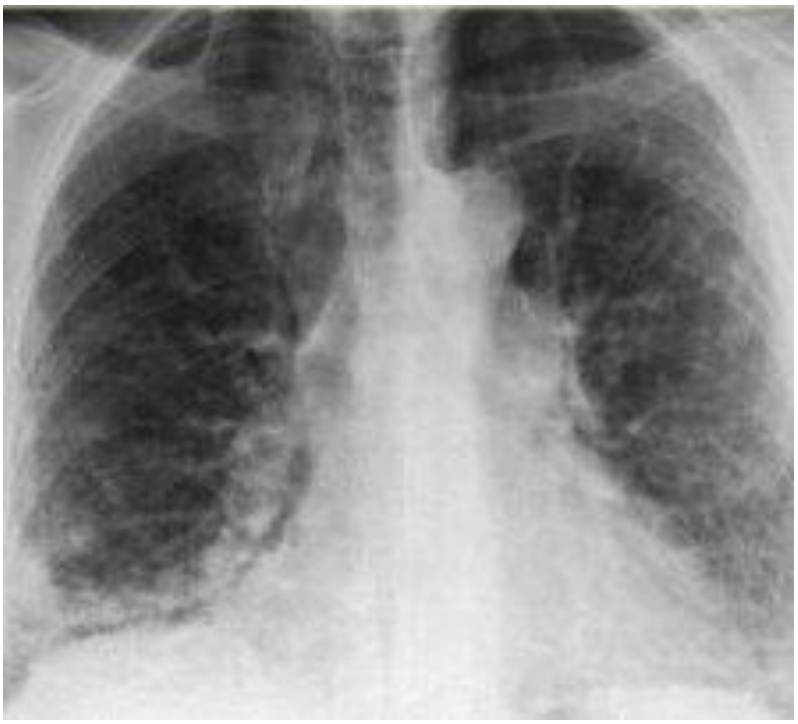
Inter and tntralobular interstitial thickening with peribronchovascular interstitial thickening



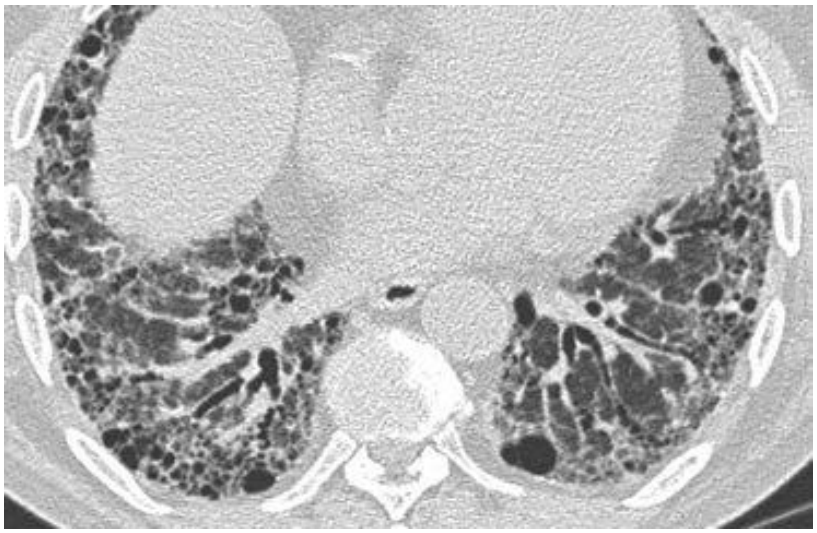
Mosaic perfusion, ground glass opacity with hyperlucent areas s/o air trapping



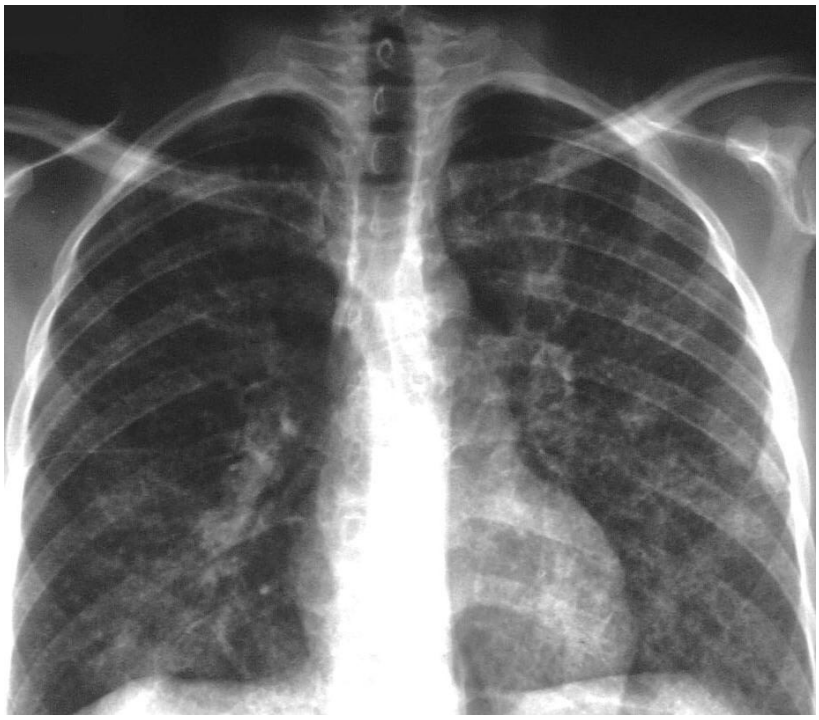
Crazy paving pattern: reticular pattern superimposed on ground glass opacification.



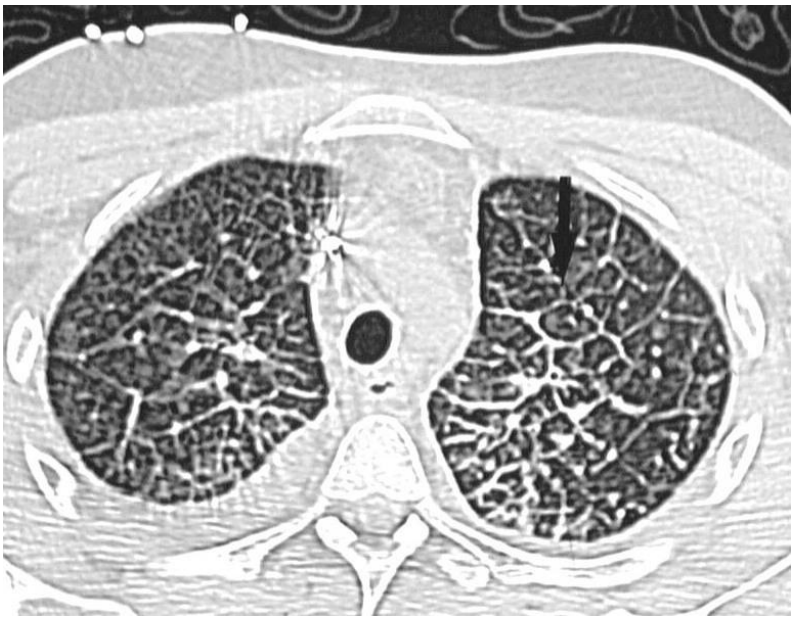
Chest film in a patient demonstrating the reticular pattern in basal and subpleural distribution due to honeycombing



Honeycombing on HRCT



Diffuse, bilateral reticulonodular opacifications with Kerley B lines.



HRCT scan demonstrates irregularly thickened septa (arrow).

IV. Discussion

This study involved 35 patients with suspected diffuse lung disease who were sent to our department by various departments of RIMS. The incidence of disease is relatively less in general population but in some groups of patients such as mine workers higher incidence is seen. Incidence of diffuse lung disease has been increased due to environmental pollutants (Taylor PM, 2001). High resolution computed tomography has made possible the early detection of the disease (Muller et al, 1986; Mathieson et al.1989). In present study, 83% were males and 17% females. Males are more exposed to environmental and industrial pollutants because more males are involved in outdoor activities. So there is male predominance which in accordance with the studies by Muller et al. 1991. 80% of patients are in the age of 41 to 71 years. 34% of 40 patients are in age groups of 41 to 50 years. Diffuse lung diseases are rare in children and adolescent (Leland L. Fan 1995). Muller et al. 1991 study also shows majority of patient in the age group of 40 to 70 years.Three socio-economic groups, high-

income, average income and low income, were made based on Kuppuswamy's scale . 22.9%of patient belonged to high income group, 34.3% were of average income and 42.8% were of low income group. Higher incidence of ILD was seen in patients of low socioeconomic groups.Smoking habits are found in 55%of the patient in our series and 45% were nonsmokers. More than 95% smokers were male. According to Muller et al. 1991 and Leland L. Fan 1995, dyspnea is the commonest symptoms of diffuse lung disease. In present study-65.7% had moderate dyspnea and 31.5% had mild dyspnea and 2.8% of patients had severe dyspnea. According to Muller et al. 1991 nearly all the connective tissue disorder can affect the lung. Our study shows that 3 patients (8.5%) were suffering from connective tissue disorders. two had Rheumatoid arthritis, one patients was suffering with ankylosing spondylitis. Most of the patients had non-productive cough. 71.4% of patients, presented with cough in our series. Four patients presented with productive cough due to superadded respiratory infection. In our study 43% of patients had crepitations. Secondary infection and Bronchiectasis in some patients led to increased number of cases with crepitations. According to Muller et al.1991, crepitations are present in patients with diffuse fibrosis. Clubbing was seen in 14.3% patients. According to king TE Jr., 2002; Restrictive lung pattern is common in diffuse lung disease. In restrictive lung disease, FEV_1/FVC is either normal or raised .62% patients had increased FEV_1/FVC values. 13 patients revealed normal FEV_1/FVC. Raised Total leukocyte counts was found in 40% patients that were associated with secondary infections. Majority of secondary infection were due to tuberculosis. In plain chest x-ray 77.2 %patient had positive findings while 22.8% patients were normal. According to Epler et al. 1978 and Carrington and Gaensler 1978, 10% of patients with diffuse lung disease had normal chest radiograph. In present study, the following radiographic signs, were encountered : septal lines 28%,Reticular shadows (51.4%), nodular or reticulonodular shadows (22.8%) ground glass opacities (34.2%), honeycombing (20%)/mediastinal lymphadenopathy 8% and pleural effusion (11.4%). Findings of chest radiography were divided into predominantly upper lung involvement or lower lung involvement or nonspecific distribution 54.2% of patients had lower lung distribution. These included patients of fibrosing alveolitis, rheumatoid arthritis and idiopathic pulmonary fibrosis. 14.2% patients had involved both the upper and lower lungs without any marked predilection. 31.4% had upper lung involvement. Mathieson et al. 1989 had studied 118 patients of chronic diffuse lung disease. 23% cases were diagnosed confidently based on chest radiography alone. In our study confident diagnosis was made in 12 cases(54.2)% on chest x-ray alone. On HRCT, presence of numerous clearly visible interlobular septa always indicate the presence of an diffuse abnormality. 82.8% shows interlobular septal thickening. In a study by Leung AN et al, 54% patients who had ground glass opacity had primarily diffuse abnormality. In our study, 91.4% shows ground glass opacity. On HRCT, honeycombing is visible as cystic thin walled area of less than 1 cm. This is indicator of lung fibrosis or irreversible lung damage.16 patients showed honeycombing. 5 patient had pleural effusion which was due to superadded infection.

According to Webb WR et al. 1988 and West Cott JL, 1986. Bronchial dilatation and irregularity occurs in patients who have pulmonary fibrosis because of traction by fibrous tissue on the bronchial wall. In our series , 4 patients has tractional Bronchiectasis. These patients also suffered from secondary infection. Two patients had developed emphysema and one patient had developed cor pulmonale. Mediastinal lymphadenopathy could be detected in only three chest x rays while on HRCT it could be detected in five cases. Subtle parenchymal changes such as ground glass opacity and interlobular septal thickening were seen on HRCT in 8 cases in which no abnormality was seen in chest x rays. ground glass opacity was detected in 12 chest x rays while on HRCT it could be detected in 32 cases. HRCT findings correlated well with x ray findings and also detected some additional findings such as ground glass opacities which were difficult to detect on plain radiographs. Nodular opacities could be detected in greater no. of cases as compared to plain radiographs and their distribution could be better ascertained. In the cases of superadded infections HRCT detected the lesions readily.

V. Conclusion

Chest radiography is the initial investigation to assess a case of diffuse lung disease. Majority of the patients with diffuse lung show abnormality on a chest radiograph, but a normal chest radiograph does not rule out diffuse lung disease. HRCT is far superior to a radiograph in detecting changes within the interstitium when chest radiograph is normal. Distribution of the disease in the lung parenchyma is accurately localized by HRCT.HRCT findings correlate well wih radiographic findings and also provide with additional information which can help to reach a specific diagnosis. HRCT helps in confident diagnosis as compared to chest radiograph. Thus lung biopsies can be avoided in a large number of patients. In case of equivocal finding, it helps to guide the biopsy site. HRCT is useful for follow up of cases. Frequent biopsy is not feasible to know the course of the disease and chest radiograph is not adequate for follow up.Therefore, HRCT is essential for the diagnosis, management and follow-up of the cases of diffuse lung disease.

Acknowledgement

We acknowledges cooperation of individual who participated in the study.

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Dr Surendra Baskey "High Resolution Computed Tomographic Evaluation Of Patients Suspected Of Having Diffuse Interstitial Lung Diseases With Radiographic Correlation." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 4, 2018, pp 21-33.