JMSCR Vol||04||Issue||01||Page 8809-8817||January 2016

www.jmscr.igmpublication.org

Impact Factor 3.79
Index Copernicus Value: 5.88
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: http://dx.doi.org/10.18535/jmscr/v4i1.05

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

High Resolution Computed Tomography in Interstitial Lung Diseases.

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ABSTRACT

Introduction: *The present study was conducted to evaluate the various high resolution computed tomo graphic patterns of interstitial lung diseases, to assess the reversible (active) verses irreversible (fibrotic) interstitial lung disease with follow up examinations and to limit the differential diagnosis and to make the specific diagnosis.*

Materials and Methods: *A total number of 50 patients with suspected or known interstitial lung disease were studied by high resolution multidetector computed tomography (HRCT) over a period of 24 months.*

Results*: Idiopathic pulmonaryfibrosis,lymphangitic carcinomatosis,hypersensitivity pneumonitis,rheumatoid arthritis, miliary tuberculosis,nonspecific interstitial pneumonia, acute interstitial pneumonia,pnemocystis carinii pneumonia, cardiogenic pulmonaryedema, SLE, progressive systemic sclerosis, welder"s pnemoconiosis, sarcoidosis, silicosis. were the interstitial lung diseases.*

Conclusion: *High Resolution Computed Tomography is a standard investigation to identify and quantify anatomic pattern and distribution of various interstitial lung diseases and also evaluates activeness and progression of disease in relation to prognosis and therapy.*

Key Words *:interstitial lung diseases ,hrct*

INTRODUCTION

High resolution computed tomography (HRCT) was introduced in 1985 by Zerhouni the perfect imaging modality for characterization and diagnosis of interstitial lung diseases.[1] It differs from conventional CT by using thin collimation with high spatial frequency algorithm (Bone algorithm). In accordance with diffuse infiltrative lung diseases HRCT plays major role in finding out:

- Presence of disease in lung
- Type of disease
- Changes of active lung disease
- From which site and which type of biopsy should be performed.
- Change in disease activity following treatment.

MATERIALS AND METHODS

- A total number of 50 patients with

suspected or known interstitial lung disease were studied by high resolution multidetector computed tomography (HRCT) over a period of 24 months.

- The study group consisted of 50 patients, of this 26 were males (52%) and 24 were females (48%).The age group of patients varied from 4 years to 75 years.
- Selection criteria:

Patients were selected on the basis of:--

1) Clinical history suggestive of interstitial lung disease.
2) Known cases of interstitial lung disease.
3) Abnormal chest radiographs (with an interstitial pattern)
4) Abnormal restrictive pulmonary function tests.

RESULTS The results are presented in the form of tables (Table 1-5)

Table 1: Age and Sex Distribution of Patients

Sr No.	Age group	Total no. of Patients	Male		Female	
			No.	%	No.	%
1	< 10	1	1	100	-	-
2	11-20	3	1	33.3	2	66.6
3	21-30	2	2	100	-	-
4	31-40	5	2	40	3	60
5	41-50	16	8	50	8	50
6	51-60	9	5	55.5	4	44.5
7	61-70	11	6	54.5	5	45.5
8	71-80	3	1	33.3	2	66.6
		50	26	52	24	48

Table 2: Distribution of cases according to etiological diagnosis

Sr. No.	Diagnosis	No. of Cases	Percentage (%)
1	Iiopathic pulmonary fibrosis	11	22
2	Lymdphangitic carcinomatosis	10	20
3	Hypersensitivity pneumonitis	9	18
4	Rheumatoid arthritis	6	12
5	Miliary tuberculosis	4	8
6	Nonspecific interstitial pneumonia	2	4
7	Acute interstitial pneumonia	1	2
8	Pneumocystis carinii pneumonia	1	2
9	Cardigenic pulmonary edema	1	2
10	Systemic lupus erythematosus	1	2
11	Progressive systemic sclerosis	1	2

12	Welder's pneumoconiosis	1	2
13	Sarcoidosis	1	2
14	Silicosis	1	2

Table 3: Diagnosis and sex wise distribution of patients

Sr. No.	Diagnosis	Total	Male		Female	
			No.	%	No.	%
1	Idiopathic pulmonary fibrosis	11	5	45.5	6	54.5
2	Lymphangitic cacinomatosis	10	5	50	5	50
3	Hypersensitivity pneumonitis	9	5	55.5	4	44.5
4	Rheumatoid arthritis	6	3	50	3	50
5	Miliary tuberculosis	4	1	25	3	75
6	Nonspecific interstitial pneumonia	2	2	100	-	0
7	Acute interstitial pneumonia	1	-	0	1	100
8	Pneumocystis carinii pneumonia	1	1	100	-	0
9	Cardiogenic pulmonary edema	1	1	100	-	0
10	Systemic lupus erythematosus	1	-	0	1	100
11	Progressive systemic sclerosis (scleroderma)	1	-	0	1	100
12	Welder's pneumoconiosis (siderosis)	1	1	100	-	0
13	Sarcoidosis	1	1	100	-	0
14	Silicosis	1	1	100	-	0

Table 4: Distribution of patients according to age

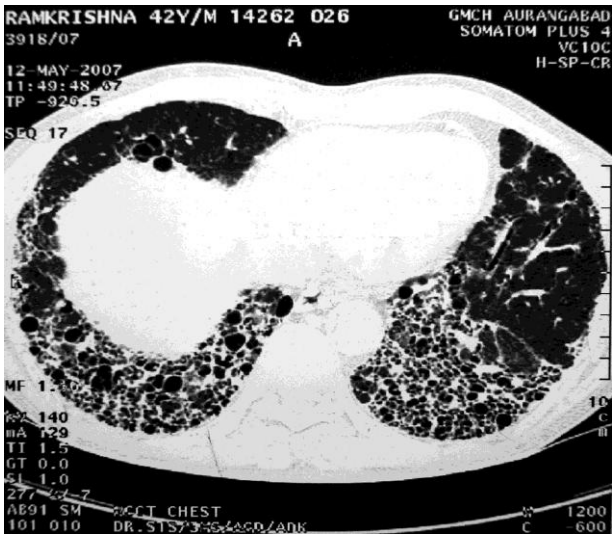
Sr. No.	Disease	Total	<10	11-20	21-30	31-40	41-50	51-60	61-71	71-80
1	Idiopathic pulmonary fibrosis	11	-	-	1	1	1	1	5	2
2	Lymphangitic carcinomotosis	10	-	-	-	-	4	3	3	-
3	Hypersensitivity pneumonitis	9	-	-	-	2	3	3	-	1
4	Rheumatoid arthritis	6	-	-	-	-	4	1	1	-
5	Miliary tuberculosis	4	-	1	-	1	1	-	1	-

6	Nonspecific interstitial pneumonia	2	-	1	-	-	-	1	-	-
7	Acute interstitial pneumonia	1	-	-	-	1	-	-	-	-
8	Pneumocystis carinii pneumonia	1	-	-	1	-	-	-	-	-
9	Cardiogenic pulmonary edema	1	1	-	-	-	-	-	-	-
10	Systemic lupus erythematosus	1	-	1	-	-	-	-	-	-
11	Progressive systemic sclerosis (scleroderma)	1	-	-	-	-	1	-	-	-
12	Welder's pneumoconiosis (siderosis)	1	-	-	-	-	1	-	-	-
13	Sarcoidosis	1	-	-	-	-	1	-	-	-
14	Silicosis	1	-	-	-	-	-	-	1	-

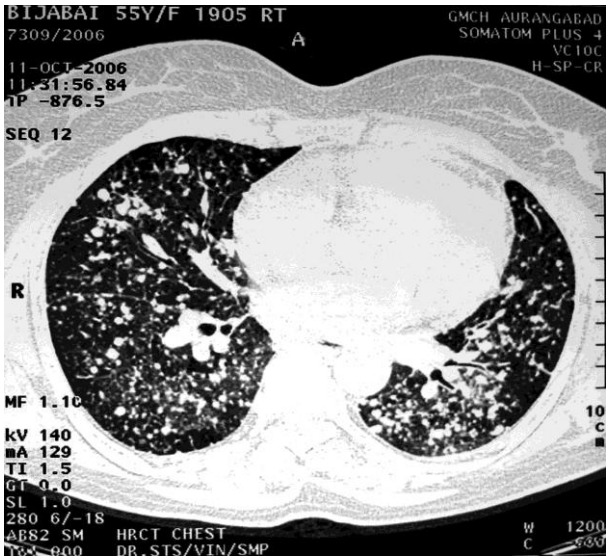
Table 5: HRCT findings of interstitial lung diseases observed in 50 patients

Sr. No	HRCT Findings	IPF	LC	HP	RA	Miliary TB	NSIP	AIP	PCP	CPE	SLE	PSS	WP	SAR	Silicosis	Total	%
1	Reticular	11	10	5	5	-	2	-	-	1	1	1	-	-	-	36	72
2	Nodular	-	8	4	2	4	1	1	1	-	-	-	1	1	1	24	48
3	Ground-glass opacity	10	3	8	5	1	1	1	1	1	1	1	-	-	1	34	68
4	Honeycombing	11	-	6	5	-	1	-	-	-	-	1	-	-	-	24	48
5	Cysts/cystic air spaces	7	-	1	2	-	-	-	-	-	-	1	-	-	-	11	22
6	Consolidation	-	3	3	-	-	2	1	1	1	1	-	-	-	1	13	26
7	Bronchiectasis	11	-	3	5	-	-	-	-	-	-	1	-	-	-	20	40
8	Fissural thickening	--	1	-	-	-	-	-	-	1	-	-	-	1	1	4	8
9	Emphysema	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	2
10	Cavity	-	-	-	1	-	-	-	-	1	-	-	-	-	-	2	4
11	Fibrotic strands	6	3	5	4	-	-	-	-	-	-	-	-	-	-	18	36
12	Pleural thickening	-	-	-	2	-	-	-	-	-	-	-	-	-	1	3	6
13	Pleural effusion		1			1				1	1				1	8	16
14	Lymphadenopathy	-	2	2	-	1	-	-	-	-	-	-	-	1	1	7	14

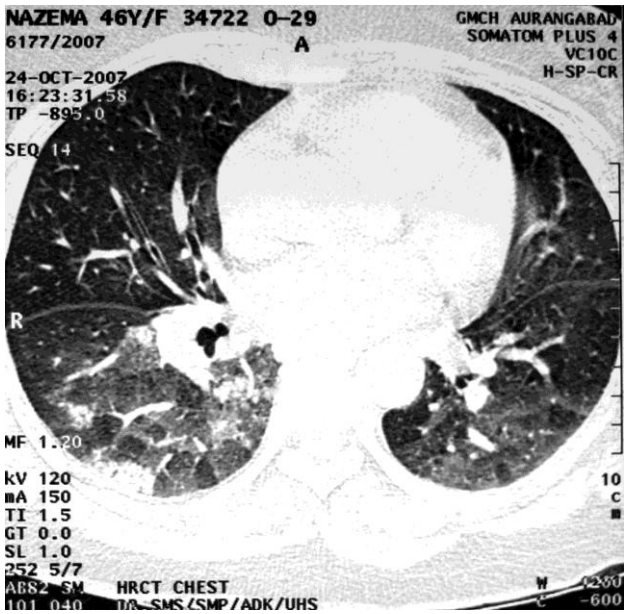
1.IDIOPATHIC PULMONARY FIBROSIS



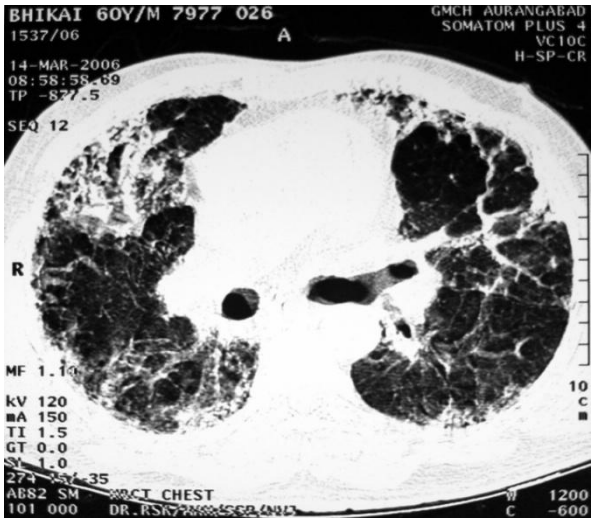
2.LYMPHANGITIC CARCINOMATOSIS



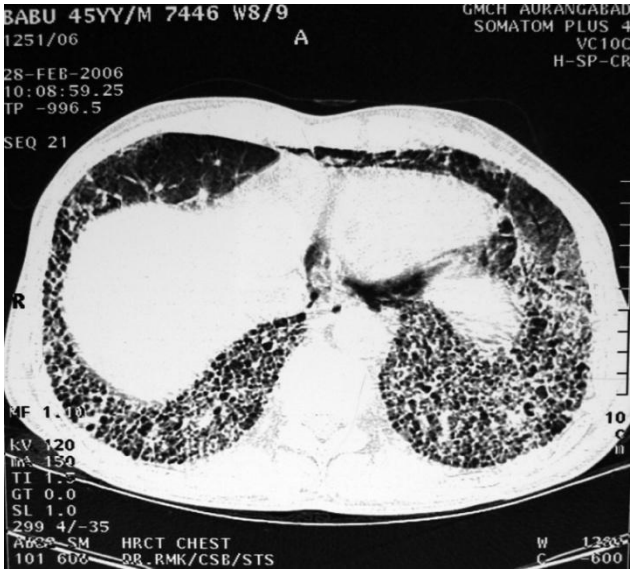
3.HYPERSENSITIVITY PNEUMONITIS (SUBACUTE)



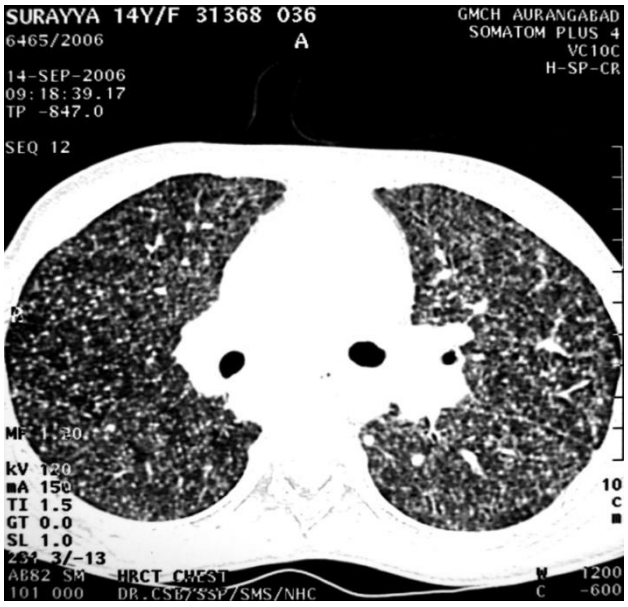
4. HYPERSENSITIVITY PNEUMONITIS (CHRONIC)



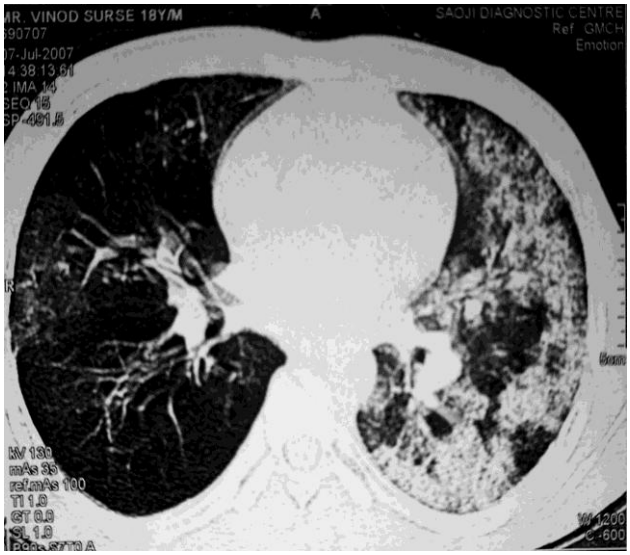
5.RHEUMATOID ARTHRITIS



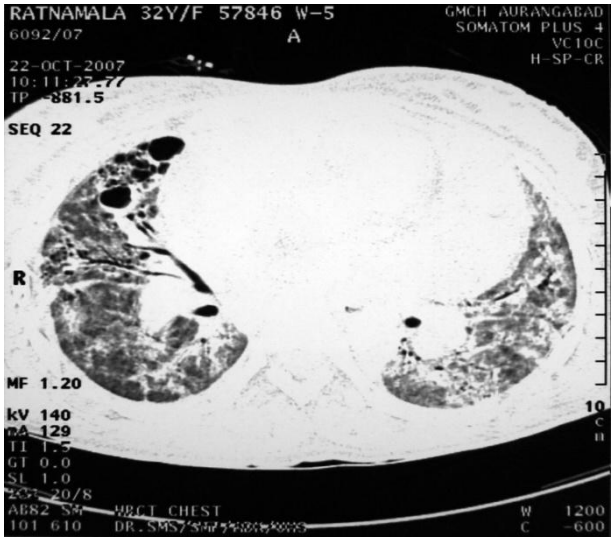
6.MILIARY TUBERCULOSIS



7.NONSPECIFIC INTERSTITIAL PNEUMONIA



8. ACUTE INTERSTITIAL PNEUMONIA



DISCUSSION

Idiopathic Pulmonary Fibrosis

In the present study 11 cases were of IPF. Out of them 5 (45.5%) were males and 6 (54.5%) were females. On HRCT, posterior basal and subpleural areas were most commonly affected and seen in all patients (100%). Middle lobes and anterior segments of upper lobes were seen in 3 patients suggesting disease process begins in posterior basal region and progressively involves upper regions of lungs.[2,3] "Honeycombing" was commonest finding observed in all cases seen predominantly in subpleural and basal regions. Honeycombing indicates irreversible and end stage disease. Finding of honeycombing formed as a thick walled small air containing cystic spaces sharing walls and lying in layers in posterior basal regions.[4] In two patients over the follow up after six months of gap, areas of honeycombing progressively increased and involved also the midzones.[5]

"Ground-glass opacity" was seen diffusely in 10 (91%) patients associated with findings of fibrosis hence representing irreversible disease process. Two patients on follow up showed honeycombing formation in the areas of ground-glass opacity previously seen.[5] Intralobular interstitial thickening producing fine reticular pattern seen in all patients predominantly in subpleural region also irregular thickening of interlobular septa and traction bronchiectasis seen in 8(73%) patient causing distortion of lung architecture.[6]

Pulmonary Lmphangitic Carcinomatosis

Ten cases (20%) of Pulmonary Lymphangitic Carcinomatosis were identified; males and females were equal in number. Ten cases were of known Carcinoma of Breast (3), Carcinoma of lung (3), Bronchoalveolar carcinoma (1), Carcinoma of oesophagus (1), Carcinoma of cervix (1) and soft tissue sarcoma(1). Four(40%) cases showed nodular peribronchovascular interstitium and also thickening of subpleural interstitium.[7] Seven cases showed smooth as well as nodular thickening of interlobular septa giving reticular pattern without distortion of lung architecture . In one (10%) case there was nodular thickening of interlobar fissures on either side. Ground-glass opacities seen in four (40%) patients were in upper zones and area of consolidation was seen in one case. Five cases (50%) showed associated findings of hematogeneous metastasis. Two cases (20%) showed associated mediastinal lymphadenopathy and four (40%) showed pleural effusion.

Hypersensitivity Pneumonitis

The study included 9 (18%) patients of hypersensitivity pneumonitis of which 3 (33.3%) were subacute and 6 (66.6%) were chronic. Two patients of subacute type showed small poorly defined centrilobular nodules and all three showed patchy areas of ground-glass opacities and variable perfusion.[8] Out of 6 cases of chronic type, 5 showed patchy or diffuse areas of ground-glass opacities. Middle lung zones and anterior parts are commonly involved with relative sparing of apical and basal regions. Findings of fibrosis were seen in all six patients predominently subpleural and peribronchovascular distribution.

Rheumatoid Arthritis

Six (12%) cases of rheumatoid arthritis with lung involvement have been identified. Five (83%) patients showed patchy or diffuse areas of ground-glass opacity and subpleural honeycombing with reticular pattern.[9] In one patient few of these nodules were cavitatory.

Miliary Tuberculosis

Study included four (8%) cases of miliary tuberculosis showed randomly distributed nodules, majority of them range between 1 to 3 mm few of them seen up to 5mm, but perivascular and subpleural are commonly involved regions.[10]

Nonspecific Interstitial Pneumonia

Two (4%) cases of nonspecific interstitial pneumonia were identified.

Two (100%) cases showed patchy areas of consolidation which are peripheral and subpleural in location with patchy ground-glass opacities and reticulations which are corresponded pathologically to the areas of interstitial thickening caused by interstitial inflammation.[11]

Acute Interstitial Pneumonia

Study included one (2%) case of acute interstitial

pneumonia. This case showed diffuse ground-glass opacity with discrete areas of alveolar consolidation involving both the lungs.[12,13]

Areas of traction bronchiectasis as well as subpleural areas of honeycombing were associated with ground-glass opacity and airspace opacification indicating proliferative to chronic fibrotic stage.[14]

Pneumocystis Carinii Pneumonia

One case of pneumocystis carinii pneumonia was seropositive for HIV.Predominant perihilar distribution of ground-glass opacities and adjacent nodular opacities were observed in this case, showing visible vessels in these areas with interstitial involvement,[15] cystic spaces observed along with bronchial wall thickening with sparing of subpleural region and patchy area of consolidation.[16]

Cardiogenic Pulmonary Edema

Study included one (2%) case of cardiogenic pulmonary edema.

Patchy areas of ground-glass opacities and consolidation with interlobular septal thickening which is smooth and uniform.[17]

Systemic Lupus Erythematosus

One (2%) case of systemic lupus erythematosus with lung involvement showed thickening of interlobular septa and peribronchovascular interstitial thickening.Areas of Interstitial pneumonitis (Lupus Pneumonitis) which were subpleural and in posterior lower zones.[18]

Progressive Systemic Sclerosis (Scleroderma)

One (2%) case of scleroderma with lung involvement was included in this study. Diffuse ground-glass opacity along with honeycombing with cysts representing changes of fibrosing alveolitis.Abnormalities were predominantly seen in subpleural regions and lower zone involvement.[19]

Welder's Pneumoconiosis (Siderosis)

Study included one (2%) case of Welder's pneumoconiosis. The patient was arc-welder for many years. Poorly defined small centrilobular micronodules and few branching centrilobular nodules in peripheral subpeural regions.[20]

Sarcoidosis

One (2%) case of sarcoidosis was included in this study.

Small nodules representing confluence of epitheloid granulomas were seen along bronchi, vessels in centrilobular regions and in subplueral regions.[21] are HRCT changes are homogeneously distributed and predominantly in upper zones.[22]

Silicosis

One (2%) case of silicosis were included in this study. Patient's occupation was grinding for almost 30 years. Conglomerated nodular opacities which are predominantly in subpleural regions. and seen in upper and posterior zones in this case.[23,24]

CONCLUSION

Idiopathic Pulmonary Fibrosis predominantly affects peripheral subpleural and posterior basal regions. The principal findings include intralobular interstitial thickening with honeycombing and cysts. Ground-glass opacity can be commonly seen in early stages of disease with progression of fibrosis in these areas in chronic stage. Distortion of lung architecture is common in IPF. Thickening of interlobular septa was commonly seen in Pulmonary Lymphangitic Carcinomatosis. Peribronchovascular, subpleural and centrilobular core, interstitial nodular opacities represent the lymphatic distribution of nodules. Involvement of lung in PLC is asymmetric and no zonal predominance is associated. Normal architecture at lobular level is preserved. Subacute type of Hypersensitivity Pneumonitis predominantly affects mid zones and consists of patchy areas of consolidations, nodular and ground-glass opacities with mosaic perfusion. Chronic type of HP may involve middle as well as lower zones and fine honeycombing associated usually with ground-glass opacities without distortion of lung architecture, with sparing of bases. Lung involvement in Rheumatoid Arthritis is fibrogenic resembling like IPF and includes ground-glass opacity associated with honeycombing, traction bronchiectasis, irregular interfaces and thickening of peribronchovascular interstitium.

Multiple randomly distributed small (1 to 3mm) nodules with sparing of apices are characteristic of Miliary Tuberculosis. Nodules may be associated with ground-glass opacity and reticular opacities. Nonspecific Interstitial Pneumonia shows patchy areas of consolidation predominantly in subpleural region. Fine honeycombing and ground-glass opacities may be associated with consolidation. Diffuse ground-glass opacity, patchy areas of consolidation associated with traction bronchiectasis and cystic areas are the features of proliferative to fibrotic stage of Acute Interstitial Pneumonia.

Pneumocystis Carinii Pneumonia shows perihilar distribution of abnormalities. Ground-glass opacities, centrilobular nodular opacities and few cystic spaces are main findings in PCP. Predominant findings in Cardiogenic Pulmonary Edema are smooth thickening of interlobular septa associated with pericardial, pleural effusion and increased calibre of pulmonary vessels. HRCT features of Systemic Lupus Erythematosus are interlobular interstitial thickening, ground-glass opacity and consolidation.

The HRCT findings of interstitial fibrosis in Progressive Systemic Sclerosis are similar to those of IPF, includes ground-glass opacities, fine honeycombing with predominant subpleural distribution. Multiple micronodules in centrilobular core seen diffusely distributed in lungs without any changes of fibrosis are findings of Welder's Pneumoconiosis. The HRCT findings of Sarcoidosis are diffusely distributed nodular opacities predominantly in the lymphatic regions and nodular thickening of the interlobar fissures. Conglomerated nodular opacities in posterior region of upper lobes, few of them calcified along with branching nodular opacities in the subpleural region represent the Silicosis on HRCT. Silicosis shows calcified mediastinal lymphadenopathy.

Interstitial lung disease (ILD) may be a characteristic often serious manifestation of mixed connective tissue disease. Hence High Resolution Computed Tomography is a standard investigation to identify and quantify anatomic pattern and distribution of various interstitial lung diseases and also evaluates activeness and progression of disease in relation to prognosis and therapy.

Sources of support-Nil
Conflict of interest-None

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