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## CT Thorax Evaluation In Connective Tissue Disorders

**B.K.Duara, Vineeth Skariah Abraham\****Department of Radiology, Gauhati Medical College and Hospital, Guwahati, India*

### ABSTRACT

High Resolution Computed Tomography is a non-invasive technique for evaluating patients with clinically diagnosed Connective Tissue Disorders and plays an important role in detecting early morphologic changes in patients with suspected pulmonary disorders such as interstitial lung disease and bronchiectasis. Aims of this study were to evaluate the High Resolution Computed Tomography thorax findings and identify specific patterns of involvement in different connective tissue disorders. The study was done as a hospital based cross sectional descriptive study comprised of 60 consecutive patients who were clinically diagnosed with a connective tissue disorder from April 2018 to March 2019 for a period of 12 months in the Department of Radio diagnosis, Gauhati Medical College and Hospital, Guwahati. Graphpad instat 3 software and paired t test were used in the calculation. Most common Interstitial lung disease pattern was Nonspecific Interstitial Pneumonia (33%), followed by Usual Interstitial Pneumonia (16.7%) pattern. But significantly higher incidence of Usual Interstitial Pneumonia pattern and bronchiectatic changes was noted in Rheumatoid Arthritis as compared to other Connective Tissue Disorders (p values 0.0016 and 0.0148 respectively). There is significantly high percentage of pleural effusion in patients presenting with Systemic Lupus Erythematosus (p value 0.0044). There is also significantly higher occurrence of esophageal dilatation in patients with Systemic Sclerosis (p value 0.0001). High Resolution Computed Tomography evaluation is of immense importance and utility in understanding the extent and type of pulmonary involvement and in distinguishing the pattern of interstitial lung disease in different Connective Tissue Disorders.

**Keywords:** ILD: Interstitial lung disease, Connective Tissue Disorders, HRCT: High Resolution Computed Tomography, UIP: Usual Interstitial pneumonia, NSIP; Nonspecific Interstitial pneumonia.

\*Corresponding Author Email: [duarabk10@gmail.com](mailto:duarabk10@gmail.com)  
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## INTRODUCTION

HRCT is the imaging method of choice for patients with CTD, demonstrating the presence, distribution and characteristics of disease with higher sensitivity than conventional chest radiographs<sup>5</sup>. Connective tissue diseases (CTD), also known as collagen vascular diseases are a heterogeneous group of autoimmune disorders. These diseases are multi systemic and can affect any organ system<sup>1</sup>

Mostly this term is used to denote the autoimmune disorders which are classified as the systemic rheumatic diseases. This group includes Rheumatoid arthritis (RA), Systemic Lupus Erythematosus (SLE), Primary Sjögren's syndrome (SS), Primary systemic sclerosis (PSS), Polymyositis- Dermatomyositis (PM-DM) and Mixed Connective Tissue Disease (MCTD)<sup>2</sup>. (Ref Table 1)

**Table 1: Percentage of Connective tissue Diseases in the study participants**

<b>Connective tissue disorder</b>	<b>No. of Cases</b>	<b>Percentage</b>
Rheumatoid arthritis	26	43.33
SLE	13	21.67
Systemic sclerosis	9	15.00
Sjögren's syndrome	4	6.67
MCTD	4	6.67
Dermatomyositis-Polymyositis	4	6.67
Total	60	100.00

HRCT is the imaging technique of choice for evaluation of patients with connective tissue diseases, demonstrating the presence, gross characteristics and distribution of pulmonary disease with greater sensitivity than conventional chest radiographs. In certain clinical circumstances, HRCT findings can suggest a specific diagnostic process. HRCT often allows the predominant process to be identified. However, it has some limitations. In many cases, HRCT appearance is nonspecific and may or may not be related to an underlying CTD (3). Thus, radiologic findings should never be interpreted without knowledge of the clinical picture. The best approach to evaluate connective tissue disease is to recognize and analyze different patterns of involvement, which include pulmonary, pleural and mediastinal or hilar lymph node involvement. Interstitial lung disease (ILD) is a challenging clinical entity that can be associated with multiple CTDs. Early and correct diagnosis of pulmonary involvement in Connective tissue diseases is important because of its therapeutic and prognostic implications. Prompt treatment often lead to improved outcomes<sup>3</sup>.

The two CT findings which are mostly responsible for a large part of the mortality and morbidity in this patient group are pulmonary arterial hypertension and interstitial lung disease<sup>4</sup>.

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## MATERIALS AND METHOD

This cross sectional study comprised of 60 consecutive patients who were clinically diagnosed as a connective tissue disorder. Institutional ethics Committee number was MC/190/2007/Pt-1/1EC/58. Sample size was calculated using the prevalence variable <sup>6</sup>

The minimum sample size is 60.

$$N=Z^2 \times p(1-p)/d^2$$

Both in-patients and out-patients attending Gauhati Medical College and Hospital, Guwahati were taken up for study. The study was conducted from April 2018 to March 2019 for a period of 12 months in the Department of Radiodiagnosis, Gauhati Medical College and Hospital. All patients clinically diagnosed as a connective tissue disorder were subjected for CT thorax evaluation. Clinical diagnosis was based on history, examination and blood tests.

### Data Collection and Procedure:

A detailed history of all the patients was taken and clinical obvious signs and symptoms and risk factors documented on a pre typed proforma. All the patients underwent routine blood investigation and other investigations. However, this did not form a part of the study. All the patients were subjected to CT thorax evaluation after taking informed consent for the same.

### Inclusion criteria:

- 1) Patients referred to the Department of Radiology with clinically diagnosis of connective tissue diseases. Informed consent to participate the test was prerequisite.
- 2) Patients of all age groups

### Exclusion criteria:

- 1) Patients who are unwilling to participate in the study.
- 2) Pregnant patients

Informed consent was taken from the patient/ guardian of patients enrolled in the study. The CT thorax examination was done using Phillips MX16, 16 slice CT scan system and its results were recorded in a structured format.

Slice thickness/ increment: 1 mm/0.5mm

Scanning area; Lung apex to adrenal glands

Window centering: -700 (lung window), 50(mediastinal window)

Window width: 1500(lung window), 350 (mediastinal window)

Voltage:120 KV

### Statistical analysis

Findings were subjected to standard statistical analysis using graph pad Instat version 3 software. Findings were analyzed using tests of significance and p value is calculated. Results were analyzed and logical conclusions were drawn

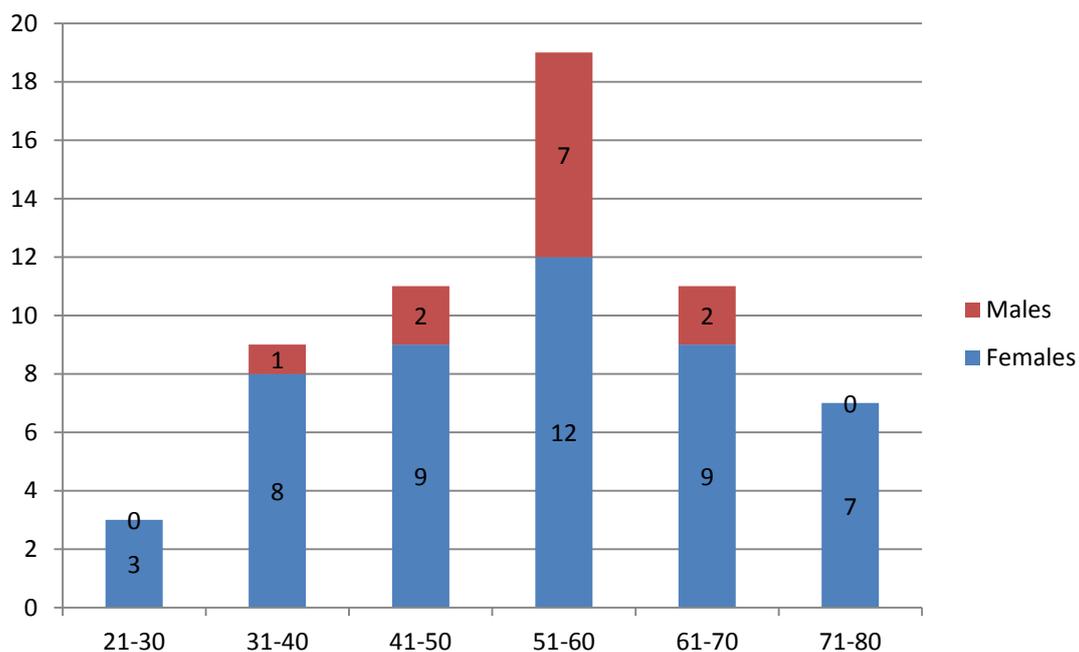
## RESULTS AND DISCUSSION

In this cross sectional descriptive study, sixty patients who were diagnosed of Connective Tissue Disorder were examined with HRCT thorax after taking informed consent. Out of 60 patients, 48 patients were females showing a 4:1 preponderance. (Ref Table 2)

**Table 2: Sex distribution of study participants**

Disease	Female N(%)	Male N(%)	Total N(%)
Rheumatoid arthritis	20(77%)	6(77%)	26(100%)
SLE	11(85%)	2(15%)	13(100%)
Systemic sclerosis	8(88%)	1(12%)	9(100%)
Sjögren's syndrome	3(75%)	1(25%)	4(100%)
MCTD	3(75%)	1(25%)	4(100%)

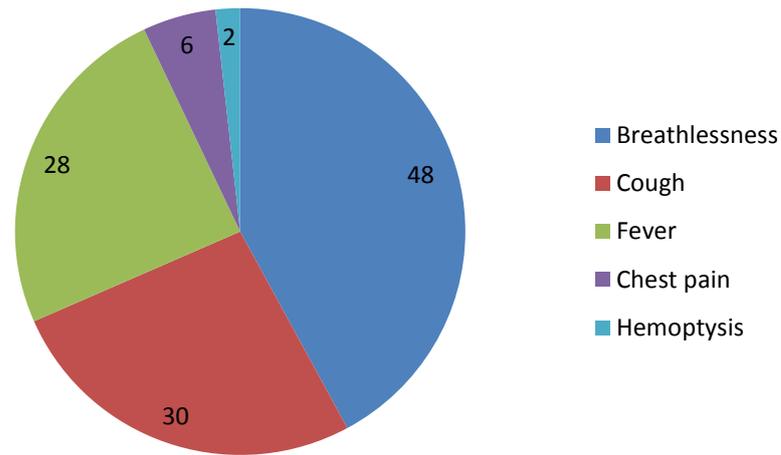
Maximum numbers of patients were from the age group 51-60 years (31.6%) with 53 patients (88.4%) above the age of 40 years.(Ref Figure 1).The Mean age of males is 55.3 years and of females is 54.4 years.



**Figure 1: Sex distribution of patients per age group**

Most patients had RA (26 patients/ 43.3%) which was followed by SLE in 13 patients (21.6%). In our study the most common presenting symptom in patients was breathlessness which constituted 80 % of patients. (Ref Figure 2)

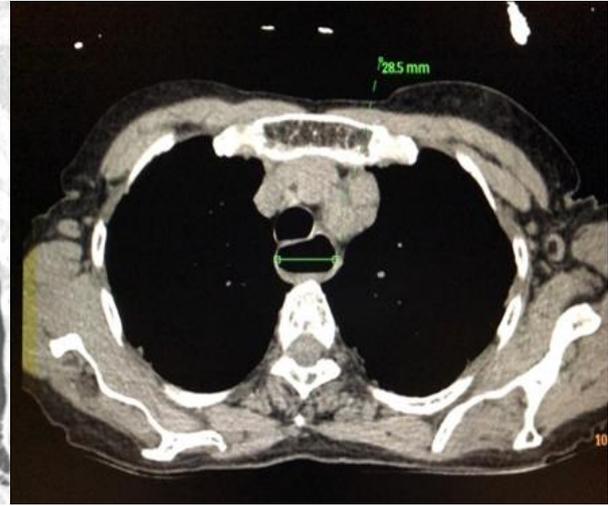
### Symptoms



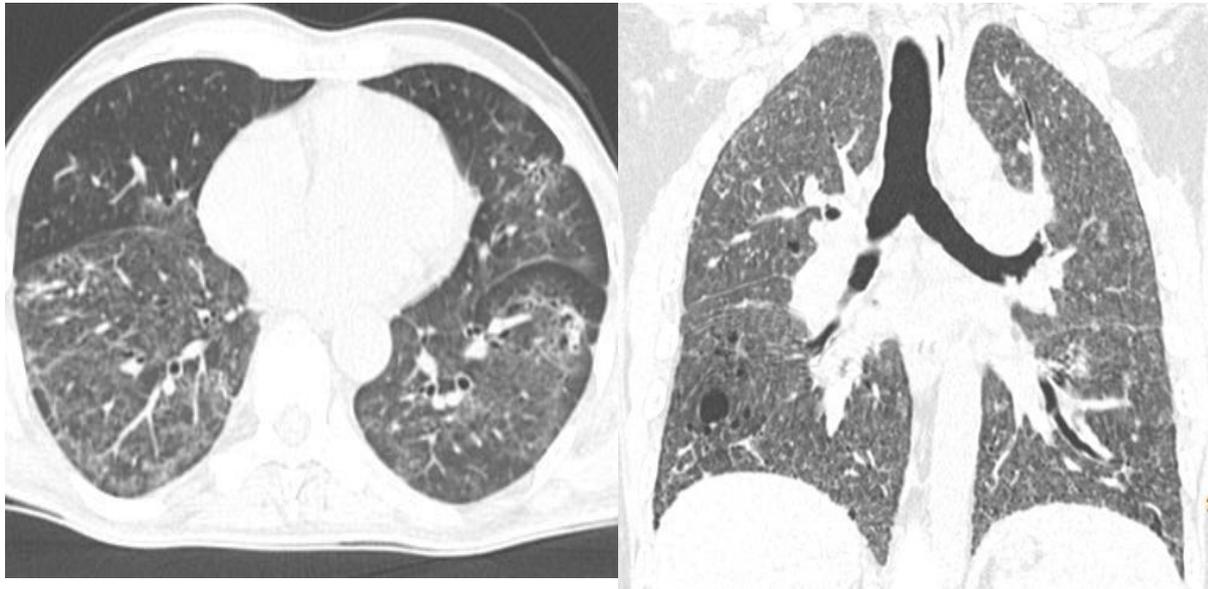
**Figure 2: Clinical symptoms in the study participants**



**Figure 3: Coronal HRCT showing UIP pattern-Honeycombing and reticular opacities in lower lobes without subpleural sparing.**



**Figure 4: Axial CT mediastinal window showing oesophageal dilatation in a case of systemic sclerosis.**



**Figure 5: Axial HRCT showing NSIP pattern with bilateral ground glass opacities with subpleural sparing** **Figure 6: Coronal HRCT showing LIP pattern with bilateral ground glass opacities with subpleural sparing**

#### Connective tissue disorders with their common HRCT findings

Reticular opacities were the most common HRCT finding in RA seen in 18 patients (69.2%) which was followed by bronchiectasis which was seen in 17 patients (Ref:table-3). Significantly higher incidence of UIP pattern (Ref: Figure 3) was noted in RA as compared to other connective tissue disorders.

**Table: 3 HRCT findings in the study participants.**

HRCT findings	RA	SLE	Sjogren's syndrome	DM-PM	MCTD	Scleroderma	Total
Reticular opacities	18	5	2	2	3	7	37
Ground glass opacity	11	4	3	4	4	8	34
Honeycombing	8		1	1	1	4	15
Nodules	1			1			2
Consolidation	1	1		2	1		5
Cysts	1		1				2
Bronchiectasis	17	2	1	1	1	3	25
Emphysema	2	1				1	4
Pleural effusion		6			1	1	8
Pleural thickening		2					2
Pulmonary artery dilatation	2					1	3
Lymphadenopathy						1	1
Esophageal dilatation						7	7

There were 13 patients of SLE evaluated in whom pleural effusion was the most common HRCT finding which was seen in 6 patients (46.1%). This was followed by reticular opacities which was seen in 5 patients (38.4%).

Nine patients with Primary Systemic Sclerosis were present in the study and the most common finding was ground glass opacities which was seen in 88.9% patients. The frequency of esophageal dilatation (Ref: Figure 4) was found to be significantly higher in Primary Systemic Sclerosis as compared to other CTD in this study. All of the 4 MCTD patients showed ground glass opacities which was followed by reticular opacities seen in 3 patients (75%).

All of the 4 Dermatomyositis-Polymyositis patients had ground glass opacities which was followed by reticular opacities and consolidation, which were noted in 2 patients each (50%).

The most common finding in Sjögren's syndrome patients was ground glass opacities which were seen in 3 patients (75%). (Ref table 3)

**Table 4: Patterns of ILD in different connective tissue disorders.**

CTD	NSIP	UIP	OP	LIP	DAD
Rheumatoid arthritis	7	8	1	1	0
Systemic Lupus Erythematosus	4	1	0	0	1
Primary Systemic sclerosis	4	1	0	0	0
Sjogren's syndrome	1	0	0	1	0
Mixed connective tissue disorder	2	0	1	0	0
Dermatomyositis-Polymyositis	2	0	1	0	0
P VALUE	0.6602	0.3331	0.2850	0.1292	0.3987

Most common ILD pattern was NSIP (33%), (Ref figure 5) followed by UIP (16.7%) pattern (Ref figure 3). But significantly higher incidence of UIP pattern was noted in RA as compared to other connective tissue disorders. There is also significantly high frequency of bronchelectatic changes in RA patients. LIP pattern (Ref figure 6) was seen in one patients each with RA and Sjögren's Syndrome.

There is significantly high percentage of pleural effusion in patients presenting with SLE. There is also significantly higher occurrence of esophageal dilatation in patients with systemic sclerosis. There is considerable overlap of the pulmonary involvement patterns in different connective tissue disorders studied.

There is no statistically significant correlation between the ILD patterns and any connective tissue disorders as p value is more than 0.05 suggesting overlapping of presentation by the diseases of connective tissue spectrum.

A female preponderance of 4:1 was noted in the study. Breathlessness was the most common presenting symptom. The mean age of the patients is 54.7years. Of the RA patients the most common finding was reticular opacities which were seen in 18 patients (69.2%). The most common finding among SLE patients was pleural effusion seen in 6 patients (46.1%).

Most common HRCT thorax finding in systemic sclerosis was ground glass opacities which was seen in 8 patients (88.8 %). Oesophageal dilatation was seen in 7 patients with systemic sclerosis (77.7%). Most common HRCT thorax finding in Sjögren's Syndrome was ground

glass opacities which were seen in 3 patients (75 %). Most common HRCT thorax finding in MCTD was ground glass opacities.

The female preponderance of 4:1 was similar to study conducted by Galhotra *et al*<sup>7</sup> in 2018 (which showed that 82.9% of the patients were females) and by Afeltra *et al*<sup>8</sup> in 2006.

The previous studies conducted by S.K.Verma *et al*<sup>9</sup> in 2013 (in which 80% presented with breathlessness) and by Galhotra *et al*<sup>7</sup> in 2018 found breathlessness as the most common presenting symptom which is in agreement with the present study.

The mean age of the patients is 54.7years in agreement with the study by Bilgici *et al* (2004)<sup>10</sup> giving mean age 53.6 years.

In the present study, among the RA patients the most common finding was reticular opacities which correlates with the previous studies conducted by Galhotra *et al*<sup>6</sup> in 2018 which showed similar frequency of reticular opacities (66.7%) and other studies done by Biederer *et al*<sup>10</sup> in 2004 and Mohd Noor *et al*<sup>12</sup> in 2009.

In the present study, among the SLE patients was pleural effusion seen in 46.1% of patients (This is in accordance with the previous study conducted by S.K.Verma *et al*<sup>7</sup> in 2013 and Alamoudi *et al*<sup>13</sup> (2015). In study conducted by Ping Li *et al*<sup>14</sup> (2016) ground glass opacities were obtained in 30.77% of the patients with SLE which is in close concordance with the present study.

Most common HRCT thorax finding in systemic sclerosis was ground glass opacities which is in concordance with the study conducted by Goldin *et al*<sup>15</sup> in 2008 which showed similar frequency (91.2%) of ground glass opacities.

Oesophageal dilatation was seen in 7 patients with systemic sclerosis (77.7%). Similar result were obtained by studies of Bhalla *et al*<sup>16</sup> in (80%). and Vonk *et al*<sup>17</sup>. in 2008, (83 %). Maghropy *et al*<sup>18</sup> (2013), in his study showed 90% frequency of ground glass opacities in Primary Systemic Sclerosis.

In the present study, among the Sjögren's Syndrome patients the most common finding was ground glass opacities which was seen in 3 patients (75 %) in agreement with Parambil *et al*<sup>19</sup> study in 2006.

Most common HRCT thorax finding in MCTD was ground glass opacities. The studies conducted by S.K.Verma *et al* in 2013 and Kozhuka *et al*<sup>20</sup> in 2001 showed similar frequency of GGO.

## CONCLUSION

Significantly higher incidence of UIP pattern was noted in RA as compared to other connective tissue disorders. There is also significantly high frequency of bronchelectatic changes in RA patients. There is significantly high percentage of pleural effusion in patients presenting with

SLE. There is also significantly higher occurrence of oesophageal dilatation in patients with systemic sclerosis. There is considerable overlap of the pulmonary involvement patterns in different connective tissue disorders studied.

## LIST OF ABBREVIATIONS

RA- Rheumatoid arthritis

SLE- Systemic Lupus Erythematosus

SS- Primary Sjögren's syndrome

PSS- Primary systemic sclerosis

PM-DM- Polymyositis-Dermatomyositis

MCTD- Mixed Connective Tissue Disease

HRCT- High Resolution Computed Tomography.

UIP-Usual Interstitial Pneumonia

NSIP-Non Specific Interstitial Pneumonia

OP-Organizing Pneumonia

LIP-Lymphoid Interstitial Pneumonia.

DAD- Diffuse Alveolar Damage.

Connective Tissue Diseases – CTD

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