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Role of High Resolution Computed Tomography in Diagnosis of Interstitial Lung Diseases in Patients with Collagen Diseases

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ABSTRACT

Aim of the work: a descriptive study including analysis of HRCT chest done for patients known to have collagen diseases for diagnosis and classification of interstitial lung diseases.

Patients and methods: forty five patients were included in our study (23 rheumatoid arthritis, 14 systemic lupus erythematosis and 8 scleroderma). This was a retrospective study that included patients with collagen diseases either outpatients or referred from the Rheumatology Departement at Ain Shams University Hospitals to the Radiodiagnosis Department for HRCT chest examination.

HRCT chest images were interpreted for identification of lung interstitium architectural abnormalities associated with collagen diseases and they were statistically analyzed. **Results**: The mean age of the selected patients was about 42 years old. Parenchymal involvement was noted in 30 cases that represented 66.6% of included cases in the study, 15 cases had normal HRCT of the chest representing 33.4% of the cases. **Conclusion**: HRCT of the chest has a reasonable role in the diagnosis of interstitial lung diseases and has the ability to be classify according to the pattern of involvement, distribution and extent of the disease as well as to estimate the severity and help in prognosis of the disease process.

Keywords: High resolution computed tomography (HRCT); Interstitial lung diseases (ILD); Collagen diseases (CD); Rheumatoid arthritis (RA); Systemic Lupus Erythematosis (SLE); Systemic Sclerosis (SS)

INTRODUCTION

Collagen vascular diseases (CVDs), also known as connective tissue disorders (CTDs), include a diverse group of immunologically mediated inflammatory disorders. Systemic inflammatory response may affect many organs. Lung disease-especially interstitial lung disease (ILD)-is frequent in the course of rheumatological diseases and causes mortality and morbidity rates to increase. Since the overall incidence of ILD has been estimated at 15%, physicians are urged to make an early diagnosis and decide the best treatment for ILD in CVDs [1].

Interstitial lung disease (ILD) is frequent in collagen vascular diseases (CVD) such as scleroderma, Sjogren's syndrome, systemic lupus erythematosus, rheumatoid arthritis, and polymyositis-dermatomyositis (PM–DM). Although the clinical features of ILD associated with CVD are similar to those of idiopathic interstitial pneumonia (IIP), the survival in CVD-ILD is much better, and most patients have a chronic indolent course [2].

Some of the most pressing challenges associated with interstitial lung disease (ILD) are how best to define, diagnose and treat connective tissue disease-associated ILD (CTD-ILD)—disorders with potentially substantial morbidity and mortality [3].

ILD was defined as restrictive lung function impairment (TLC and DLCO <80% predicted) and/or radiologic signs consistent with ILD on chest radiograph or HRCT [4].

Interstitial lung disease (ILD) includes a heterogeneous group of disorders that result in diffuse parenchymal lung disease, with overlapping clinical, radiographic, and physiologic manifestations [5].

HRCT is valuable in detecting ILD in patients with a normal chest radiograph. In the appropriate clinical setting, appearances on the HRCT scan may be sufficiently characteristic to preclude the need for broncho-alveolar lavage (BAL) or lung biopsy and histopathological confirmation. Radiologists involved with determining the protocol and interpretation of HRCT scans should have expertise in the technique, be responsible for quality assurance and ensure that an appropriate radiation dose protocol is used [6]. ILD on HRCT was defined by the presence of at least 1 of the 2 following radiologic features: ground-glass opacification, and a reticular pattern including reticulation, bronchiectasis due to retraction, and honeycombing (micro- or macrocystic reticular pattern) [7].

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PATIENTS AND METHODS

Study population:

This was a retrospective study that included 45 patients with collagen diseases either outpatients or referred from the Rheumatology Department at Ain Shams University Hospitals to the Radiodiagnosis Department for HRCT chest examination.

Inclusion criteria

- Patients of any age with clinically evident collagen diseases (Rheumatoid arthritis, systemic lupus erythematosis or scleroderma) are complaining of chest symptoms.
- Both sexes will be included.

Exclusion criteria

- Patients with unavailable history or clinical diagnosis.
- Patients with low quality of CT images either technical or due to breathing motion artifacts that could alter the image interpretation.

Procedure:

- Patients were subjected to full history taking and clinical examination.
- All patients then underwent HRCT chest examination .The study was done in the CT unit at Ain shams university hospitals by General Electric Bright Speed Elite 16 slices CT device.
- An acceptance from the ethical committee of the Radiology Department of Ain Shams University Hospitals was obtained to use the data stored on PACs system.

Method of HRCT examination:

Thin sections were acquired with an interval of 1-2 cm between the two sets of images and considered sufficient to detect abnormalities in diffused lung diseases.

Fundamental technical protocols:

- slice thickness: 0.625-1.25 mm
- scan time: 0.5-1 second
- kV: 120
- mAs: 100-200
- collimation: 1.5-3 mm
- matrix size: 768 x 768 or the largest available
- FOV: 35 cm
- reconstruction algorithm: high spatial frequency
- window: lung window
- patient position: supine (routinely)
- Level of inspiration: full inspiration (routinely recommended).

Image Interpretation:

HRCT chest images were analyzed for identification of lung interstitium architectural abnormalities associated with collagen diseases as follow:

- ❖ Pattern of pulmonary architectural abnormality
- ❖ Location and extent.
- ❖ Suspected diagnosis/type of interstitial pattern according to the image data.
- ❖ Diameter of pulmonary artery
- ❖ Presence or absence of pleural effusion
- ❖ Associated findings.

The study was done after approval of ethical board of Ain -Shams university and an informed written consent was taken from each participant in the study

Statistical analysis

The analysis of data were done using IBM SPSS statistics (V. 24.0, IBM Corp., USA, 2016).The results were descriptive including study HRCT chest studies of 45 patients known to have collagen diseases and were interpreted for presence of interstitial lung diseases, their pattern and their suggested type. Percentages of affected and normal studies were calculated, percentages of each type and its correlation with the concurrent collagen disease was interpreted.

RESULTS

Our study was conducted on 45 patients known to have collagen diseases (23 rheumatoid arthritis, 14 systemic lupus erythematosis and 8 scleroderma) **(Table 1)** either outpatients or referred from the Rheumatology Departement at Ain Shams University Hospitals to the Radiodiagnosis Department for HRCT chest examination.

They were either asymptmatic or presented with chronic dyspnea, cough and/or chest pain, 42 patients were females and 3 were males (ratio14:1), age range was 20-70 years (average of 42 years) **(Table 2)**

The analysis of HRCT chest studies was done for the collected patients and showed parenchymal involvement in 30 cases that represented 66.6% of included cases in the study, 15 cases had normal HRCT of the chest representing 33.4% of the cases. 14 cases were found to have nonspecific interstitial pneumonia (NSIP)that were proved by the HRCT chest findings including ground glassing , reticular/nodular/reticulo-nodular pattern +/- bronchiectatic changes +/- honeycombing that

represented 46.7% of affected cases ,5 of them were known to have RA, 5 known SLE and 4 cases were known to have scleroderma.

4 of all affected cases had HRCT chest findings consistent with usual interstitial pneumonitis (UIP) that was evident by the presence of reticular/nodular/reticulo-nodular pattern of parenchymal involvement without/with minimal ground glassing, representing 13.3% of all affected cases, 2 of them are known RA, one known SLE and one known Scleroderma

3 of all affected cases were noted to have HRCT chest findings consistent with cryptogenic organizing pneumonia (COP) showing areas of consolidation with ground glassing, reticular/nodular/reticulo-nodular pattern, all of them were known RA representing 10% of all affected cases.

One case had HRCT chest findings consistent with bronchiolitis as it showed areas of air trapping together with ground glassing and reticular/nodular/reticulo-nodular pattern of involvement representing 3.3 % of affected cases.

8 of affected cases showed only ground glassing which could not be specified representing 26.7% of affected cases 8 of affected cases showed only ground glassing which could not be specified representing 26.7% of affected cases**(Table 3)**

Table 1: show the percentage of collagen diseases among selected sample

Diagnosis	Frequency	Percent	Cumulative Percent
RA	23	51.1	51.1
SLE	14	31.1	82.2
SS	8	17.8	100.0
Total	45	100.0	

Table 2: shows the age frequency among the selected sample

Age	Frequency	Percent	Cumulative Percent
20	**2**	**4.4**	**4.4**
24	**2**	**4.4**	**8.9**
26	**1**	**2.2**	**11.1**
27	**2**	**4.4**	**15.6**
30	**3**	**6.7**	**22.2**
31	**1**	**2.2**	**24.4**
32	**3**	**6.7**	**31.1**
34	**1**	**2.2**	**33.3**
39	**1**	**2.2**	**35.6**
40	**4**	**8.9**	**44.4**
42	**2**	**4.4**	**48.9**
43	**2**	**4.4**	**53.3**
45	**3**	**6.7**	**60.0**
46	**2**	**4.4**	**64.4**
47	**2**	**4.4**	**68.9**
48	**1**	**2.2**	**71.1**
49	**1**	**2.2**	**73.3**
50	**2**	**4.4**	**77.8**
52	**1**	**2.2**	**80.0**
53	**1**	**2.2**	**82.2**
54	**2**	**4.4**	**86.7**
55	**1**	**2.2**	**88.9**
56	**1**	**2.2**	**91.1**
60	**1**	**2.2**	**93.3**
65	**2**	**4.4**	**97.8**
70	**1**	**2.2**	**100.0**
Total	**45**	**100.0**	

Table 3: illustrates incidence of ILD among each type of collagen disease in the affected patients

		Diagnosis							
		RA		SLE		SS		Total	
		Count	Percent	Count	Percent	Count	Percent	Count	Percent
Type	NSIP	5	16.70%	5	16.70%	4	13.30%	14	46.70%
	UIP	2	6.70%	1	3.30%	1	3.30%	4	13.30%
	COP	3	10.00%	0	0.00%	0	0.00%	3	10.00%
	Bronchiolitis	1	3.30%	0	0.00%	0	0.00%	1	3.30%
	Not specified	3	10.00%	4	13.30%	1	3.30%	8	26.70%
	Total	14	46.70%	10	33.30%	6	20.00%	30	100.00%

DISCUSSION

This retrospective study involved reviewing the HRCT results of 45 patients with collagen diseases either outpatients or referred from the Rheumatology Departement at Ain Shams University Hospitals to the Radiodiagnosis Department for HRCT chest examination . All patients were known cases of collagen diseases (rheumatoid arthritis , systemic lupus or scleroderma) either asymptmatic or presented with chronic dyspnea , cough and/or chest pain.

The analysis of HRCT chest studies done for the collected patients includes **parenchymal involvement** that showed signs of interstitial lung diseases.According to the study done by ***Lee et al.*** [8] diffused interstitial lung diseases had been described in approximately 40% of patients with rheumatoid arthritis and ***Schur*** [9] stated that patient with longstanding SLE and anti-Ro antibodies are more likely to develop chronic pneumonitis .Also, the study of ***Kaloudi and Matucci-Cerinic*** [10] stated that there are two principal manifestations of lung involvement in scleroderma :interstitial lung diseases and pulmonary vascular disease.

Parenchymal involvement was noted in 30 cases that represented 66.6% of included cases in the study, 15 cases had normal HRCT of the chest representing 33.4% of the cases. 14 cases were found to have nonspecific interstitial pneumonia (NSIP)that was proved by the HRCT chest findings including ground glassing , reticular/nodular/reticulo-nodular pattern +/- bronchiectatic changes +/- honeycombing that represented 46.6% of affected cases ,5 of them were known to have RA ,5 known SLE and 4 cases were known to have scleroderma.

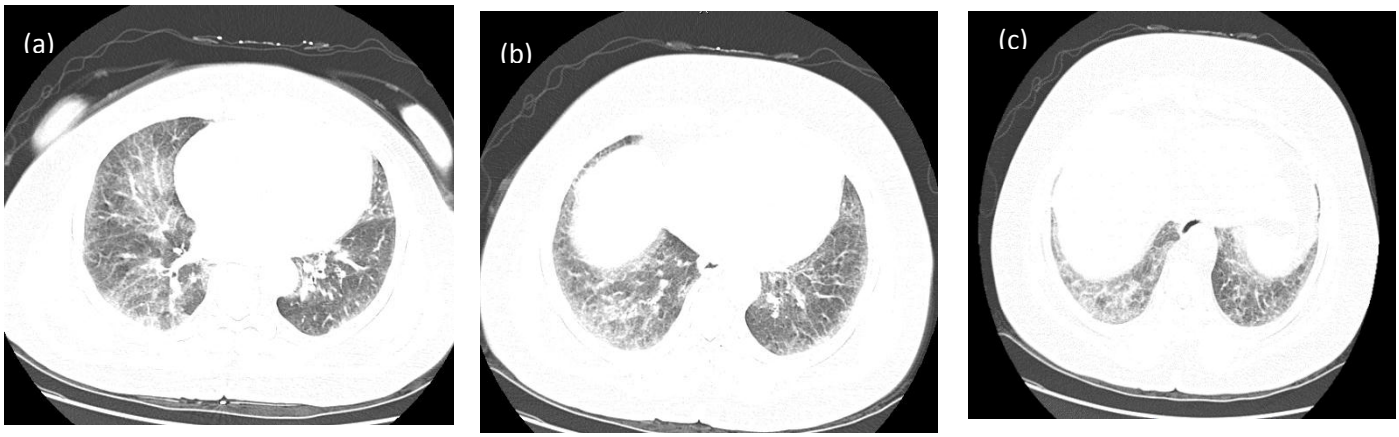
4 of all affected cases had HRCT chest findings consistent with usual interstitial pneumonitis (UIP) that was evident by the presence of reticular/nodular/reticulo-nodular pattern of parenchymal involvement without/with minimal ground glassing, representing 13.3% of all affected cases, 2 of them were known RA, one known SLE and one known scleroderma

3 of all affected cases were noted to have HRCT chest findings consistent with cryptogenic organizing pneumonia (COP) showing area of consolidation with ground glassing, reticular/nodular/reticulo-nodular pattern; all of them are known RA representing 10% of all affected cases.

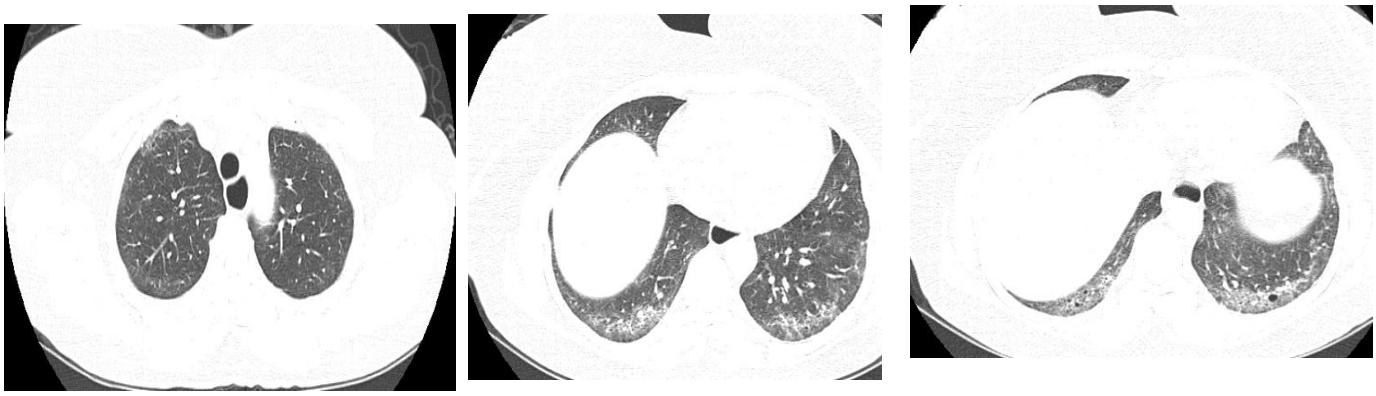
2 cases had HRCT chest findings consistent with bronchiolitis as they showed areas of air trapping together with ground glassing and reticular/nodular/reticulo-nodular pattern of involvement representing 6.6 % of affected cases.

8 of affected cases showed only ground glassing which could not be specified representing 26.6% of affected cases

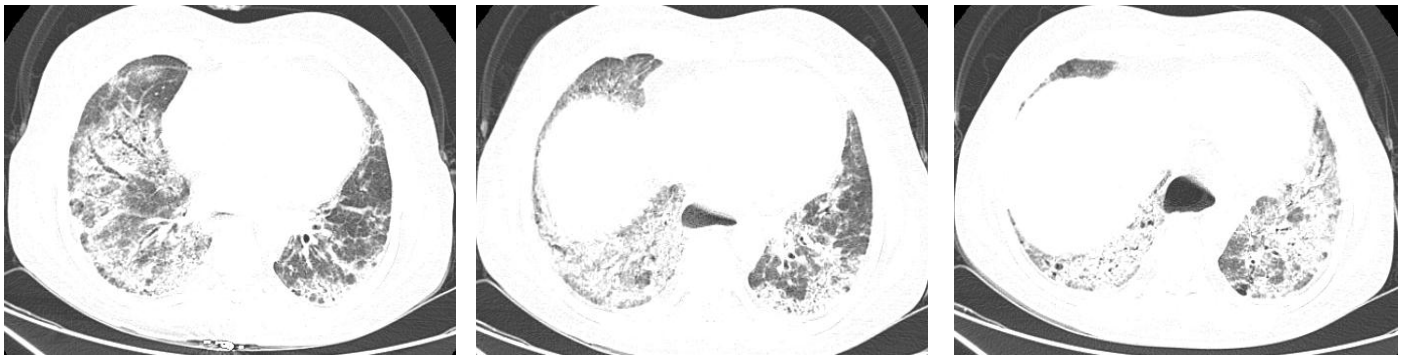
The pattern and types of parenchymal involvement in our study is against the study directed by ***Antoniou et al*** [11] that stated that in RA the UIP pattern is more common than NSIP that may be because the small sample size and consistent with the same study in that NSIP is more common than UIP and COP in patient with SLE and Scleroderma



Case 1: female patient, 56 year old, known SLE, presented with dyspnea and cough for one month duration. HRCT show bilateral lower lobar ground glassing and peripheral reticulo-nodular pattern suggestive of non-specific interstitial pneumonia (NSIP).



Case 2: female patient, 45 year old, known case of Scleroderma, presented with chronic cough, expectoration of whitish sputum. HRCT showed reticulo-nodular pattern of interstitial infiltrates mainly lower lobar with minimal honeycombing consistent with usual interstitial pneumonia (UIP).



Case3: female patient, 46 year old, known case of Rheumatoid Arthritis, presented with chronic cough, dyspnea. HRCT showed lower lobar ground glassing, reticulo-nodular pattern of interstial infiltration with honeycombind and patches of consolidation suggestive of cryptogenic organizing pneumonia (COP).

CONCLUSION

We **conclude** that the HRCT of the chest has a reasonable role in the diagnosis of interstitial lung diseases and has the ability to classify according to the pattern of involvement, distribution and extent of the disease as well as to estimate the severity and help in prognosis of the disease process.

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