



# High Resolution Computed Tomography (HRCT) for Evaluation of Pulmonary Manifestations in Patients with Autoimmune Diseases

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Background:** The systemic immune system afflictions can reason very a couple of pneumonic parenchymal, vascular, aviation route, and pleural anomalies. The highlight thoracic signs of those afflictions are incited through the basic immune system prepare.

**Aim of the Work:** Evaluation of the radiological findings on HRCT of the lung in patients with autoimmune diseases was the aim of this research

**Methods:** This retrospective cross-sectional research was conducted on 25 cases (18 female and 7 male) ranging from 20-80 years old with autoimmune diseases proved by laboratory and clinical finding attending Tanta university Hospitals. Our patients were referred from chest department to Radiology department (CT units) at Tanta University Hospitals. The period of this research was from May 2020 to May 2021.

**Results:** Chest complications are common among autoimmune patients, the most frequent chest manifestations were fatigue followed by dyspnea representing 72% and 60% respectively, 40% of patients were presented with cough, The presence of clubbing and weight loss in autoimmune individuals with chest manifestations is frequent representing about (24% and 16%) respectively.

**Conclusion:** For evaluation of patients with connective tissue diseases of chest manifestations (pain, shortness of breath, cough), HRCT is the imaging technique of choice, According to HRCT,

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ground glass opacities was the most prevalent chest findings representing 56%, followed by consolidation and bronchiectasis representing 28% and lastly pericardial effusion represents 4%.

**Keywords:** Rheumatoid arthritis; systemic lupus erythematosus; High-resolution CT.

## 1. INTRODUCTION

Immune system illnesses are those in which the body is assaulted by its claim particular versatile resistant reaction. In typical, solid states, the safe framework actuates resistance, which may be a need of an anti-self-resistant reaction. In any case, with autoimmunity, there's a risk of resistant resistance, and the instruments capable for immune system illnesses incorporate sort II, III, and IV touchiness responses. Immune system illnesses can have an assortment of blended indications that flare up and vanish, making determination difficult [1].

(RA) may be a ceaseless combustible illness commonly counting the small joints of the hands and feet in a symmetric form. Extra-articular appearance of RA is visit and may happen in basically all organ frameworks [2].

The rheumatoid joint pain (RA) can influence different organs and tissues counting the lung. A few pleuro-pulmonary signs are related with rheumatoid joint pain including the lung parenchyma, pleura, aviation routes, and vasculature [3].

SLE is the Up to directly, the exact pathogenesis and cause of this disease still murky, which are for the foremost portion recognized as the comes almost of diverse components [4]. Due to chest is well off in connective tissue, more than half of SLE patients have chest incorporation moving degrees in the midst of the course of the disease essentially counting pneumonic interstitium, pleura, respiratory muscles and aspiratory parenchyma [5]. The chest implies to a CT strategy in which thin-slice chest pictures are gotten and post-processed in a high-spatial-frequency post-processed in a high-spatial-frequency recreation calculation [6].

### 1.1 Aim of the Work

To assess the radiological findings on HRCT of the lung in patients with autoimmune diseases.

## 2. PATIENTS AND METHODS

### 2.1 Patients

This retrospective cross-sectional research was conducted on 25 cases (18 female and 7 male) ranging from 20-80 years old with autoimmune diseases proved by laboratory and clinical finding attending Tanta university Hospitals. Our patients were referred from chest department to Radiology department (CT units) at Tanta University Hospitals. The period of this study was from May 2020 to May 2021.

Ethics committee approved and informed consent were obtained for all patients or their guardians.

### 2.2 Inclusion Criteria

Patients with autoimmune disease complaining of chest manifestations (pain, shortening of breath, cough, fatigue and weight loss)

### 2.3 Exclusion Criteria

- 1- cases with mixed connective tissue disease (a disorder characterized by systemic sclerosis, polymyositis, and features of systemic lupus erythematosus (SLE),).
- 2- Inco-operative patients
- 3- patient who is not proven to be specific autoimmune disease

1. All patient in this study were subjected to:

#### A) Complete history taking including:

- Personal history: as regards the name , age and gender ,residence and phone number
- Clinical data for any complain as cough, dyspnea, weight loss, fatigue and clubbing
- Past history of any previous operation, surgical intervention, stroke and trauma were recorded.

**B) Clinical examination**

(By Doctors of chest department) including:

- General examination and vital signs (heart rate and blood pressure )
- Chest examination

**C) High resolution computed tomography chest (HRCT)**

**D) Autoantibody tests** (anti-double stranded antibody (anti-ds DNA), rheumatoid factor, anti-nuclear antibody).

**Duration of study:** Started from May 2020 to May 2021.

**Confidentiality:** We put a code number for each case; Names were hidden from any CT film to keep participants privacy and data confidentiality.

**The benefits of the study to the subjects included:** The subjects included in the study gained the benefit of early diagnosis and management of any changes detected in their imaging.

**3. RESULTS**

There is significant value between findings in X – Ray and findings in HRCT in patients with dyspnea significant predictor risk factor p= 0.031.

There is significant value between number of cases with consolidation in X – Ray and in HRCT significant predictor risk factor p= 0.009. There is significant value between number of cases with ground glass opacity in x –ray and HRCT Significant predictor risk factor p= 0.001. There is significant value between number of cases with honeycomb appearance in x-ray and HRCT Significant predictor risk factor p=0. 037. There is significant value between number of cases with bronchiectasis in x-ray and HRCT. Significant predictor risk factor p=0.009. There is significant value between number of cases with interlobular septal thickening in x-ray and HRCT Significant predictor risk factor p=0.037. There is significant value between number of cases with pulmonary nodules in x-ray and HRCT Significant predictor risk factor p=0.004.

There is significant value between ground glass opacity and disease duration significant predictor risk factor p= 0.004. There is significant value between reticular or reticulonodular appearance and disease duration significant predictor risk factor p= 0.036.

There is significant value between positive RF and HRCT and x –ray chest findings significant predictor risk factor p= 0.001.

**Table (1): Distribution of the studied cases according to age**

Age (year)	No. of studied cases	%
0 – 20n	0	0
21 – 40	2	8
41 – 60	8	32
61 – 80	15	60
<b>Mean ± SD</b>	60.6 ± 15.2	
<b>Median</b>	65	

**Table (2) : Comparison between HRCT and X- ray findings in symptomatic patients**

Clinical presentation	Findings in X- ray		Findings in HRCT		X <sup>2</sup>	P value
	N	%	N	%		
<b>Cough</b>	3	12	7	28	2.001	0.157
<b>Dyspnea</b>	4	16	11	44	4.669	0.031*
<b>Chest pain</b>	3	12	7	28	2.001	0.157
<b>Fatigue</b>	7	28	11	44	1.387	0.239
<b>Weight loss</b>	2	8	4	16	0.759	0.384
<b>Clubbing</b>	1	4	3	12	1.090	0.297

P value for association between clinical presentation and HRCT and X – ray chest findings

\*: Statistically significant at p ≤ 0.05.

**Table (3) : Comparison between HRCT and X-ray findings of the studied cases**

		Rheumatoid arthritis		Systemic lupus erythematosus		Sarcoidosis		X <sup>2</sup>	P value
		N	%	N	%	N	%		
<b>Consolidation</b>	HRCT findings	6	24	1	4	0	0	6.821	0.009*
	X-Ray finding	0	0	0	0	0	0		
<b>Ground glass opacity</b>	HRCT findings	9	36	5	20	0	0	10.976	0.001*
	X-Ray finding	0	0	0	0	0	0		
<b>Honey comb appearance</b>	HRCT findings	4	16	0	0	0	0	4.352	0.037*
	X-Ray finding	0	0	0	0	0	0		
<b>Interlobular septal thickening</b>	HRCT findings	4	16	0	0	0	0	4.352	0.037*
	X-Ray finding	0	0	0	0	0	0		
<b>Bronchiectasis</b>	HRCT findings	6	24	1	4	0	0	6.821	0.009*
	X-Ray finding	0	0	0	0	0	0		
<b>Pleural effusion</b>	HRCT findings	4	16	0	0	0	0	0.762	0.384
	X-Ray finding	2	8	0	0	0	0		
<b>Pericardial effusion</b>	HRCT findings	1	4	0	0	0	0	0.0	1.0
	X-Ray finding	1	4	0	0	0	0		
<b>Mosaic sign</b>	HRCT findings	1	4	1	4	0	0	1.016	0.312
	X-Ray finding	0	0	0	0	0	0		
<b>Pulmonary nodules</b>	HRCT findings	7	28	0	0	1	4	8.139	0.004*
	X-Ray finding	0	0	0	0	0	0		
<b>Reticular/Reticulonodular</b>	HRCT findings	6	24	1	4	0	0	0.102	0.747
	X-Ray finding	7	28	2	8	0	0		
<b>Lymphadenopathy</b>	HRCT findings	1	4	0	0	1	4	0.0	1.0
	X-Ray finding	1	4	0	0	1	4		

P value for association between HRCT and X – ray chest findings

\*: Statistically significant at p ≤ 0.05.

**Table (4) :Comparison between chest high-resolution computed tomography findings as regards disease duration**

Groups Variables	< 5 years (n=4)		5 – 10 years (n=16)		> 10 years (n=5)		X <sup>2</sup>	P value
	N	%	N	%	N	%		
<b>Consolidation</b>	2	8	2	8	3	12	5.412	0.067
<b>Ground glass opacity</b>	4	16	5	20	5	20	11.046	0.004*
<b>Honey comb appearance</b>	0	0	2	8	2	8	3.051	0.218
<b>Interlobular septal thickening</b>	1	4	1	4	2	8	3.523	0.172
<b>Bronchiectasis</b>	3	12	3	12	1	4	5.223	0.074
<b>Pleural effusion</b>	2	8	1	4	1	4	4.628	0.099
<b>Pericardial effusion</b>	0	0	1	4	0	0	0.591	0.746
<b>Pulmonary nodules</b>	3	12	3	12	2	8	4.839	0.089
<b>Reticular/Reticulonodular</b>	3	12	2	8	2	8	6.651	0.036*
<b>Lymphadenopathy</b>	0	0	1	4	1	4	1.392	0.498

**Table (5) : Comparison between the lab investigation ( Anti- ds DNA) groups and findings in HRCT and X – ray**

Anti- ds DNA	Findings in HRCT		Findings in x-ray		X <sup>2</sup>	P value
	N	%	N	%		
<b>Negative</b>	3	12	0	0	3.187	0.074
<b>Equivocal</b>	5	20	1	4	3.031	0.082
<b>Positive</b>	17	68	4	16	13.882	0.001*

P value for association between laboratory investigations ( Anti-ds DNA) and HRCT and X-Ray chest findings

\*: Statistically significant at p ≤ 0.05.

There is significant value between positive Anti-ds DNA and HRCT and x –ray chest findings

significant predictor risk factor p= 0.007

Table (6) : Comparison between the lab investigation ( ANA ) groups and findings in HRCT and X – ray

ANA	Findings in HRCT		Findings in X-ray		X <sup>2</sup>	P value
	N	%	N	%		
Negative	2	8	0	0	2.079	0.179
Equivocal	5	20	1	4	3.031	0.082
Positive	18	72	4	16	15.908	0.001*

P value for association between laboratory investigations ( ANA ) and HRCT and X-Ray chest findings

\*: Statistically significant at  $p \leq 0.05$ .

There is significant value between positive ANA and HRCT and x –ray chest findings significant predictor risk factor  $p= 0.001$

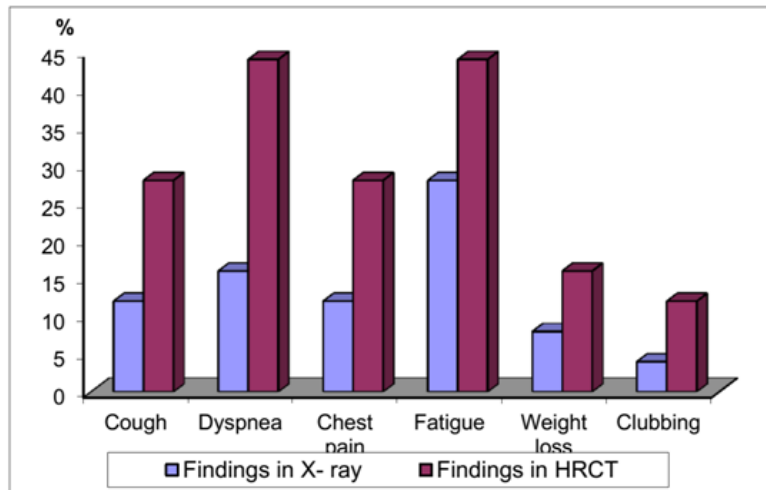


Fig. 1. Comparison between HRCT and X-ray findings in symptomatic patients

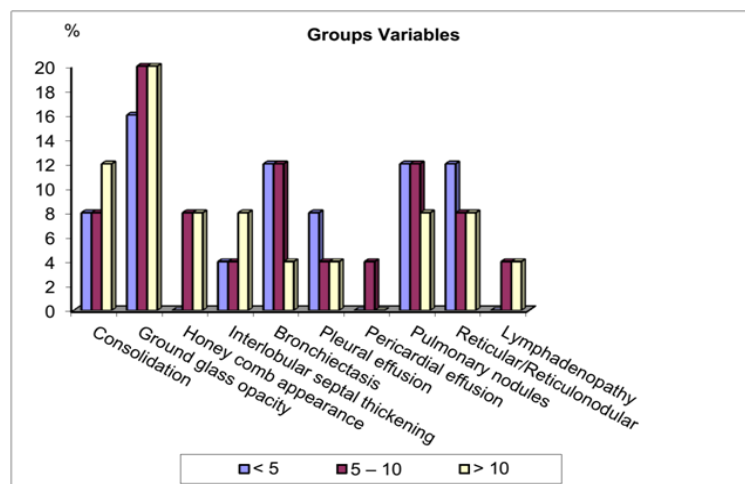
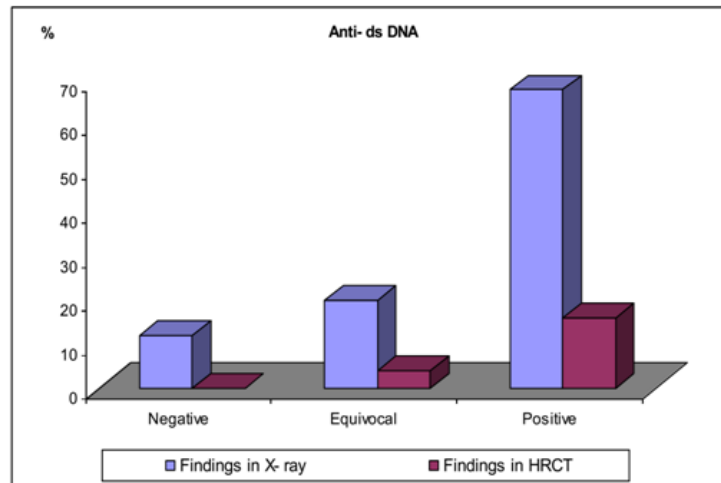


Fig. 2. Comparison between chest high-resolution computed tomography finding as regards disease duration

P value for association between disease duration and HRCT chest findings \*:Statistically significant  $p \leq 0.05$



**Fig. 3. Comparison between the lab investigation (anti-ds DNA) groups and findings ERCT and X-ray**

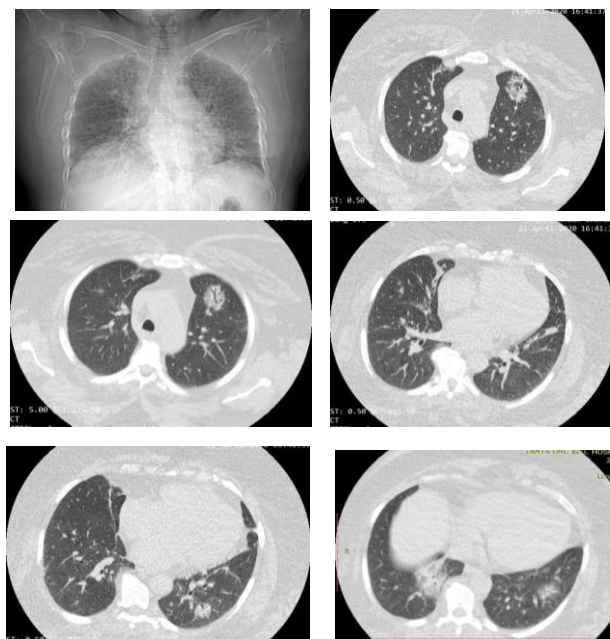
**4. CASE (2)**

65 – year- old female with history of Rheumatoid Arthritis (RA) presented with dyspnea, cough, fatigue.

HRCT shows

Multifocal clearing consolidative patches with central ground glass opacity and air bronchogram with bubbly appearance seen within, predominantly peripheral and peri-bronchial in location, seen at anterior segment of the left upper lobe, posterior segment of left lower lobe and posterior segment of right lower lobe. Focal areas of reticular subinfiltrate mounting tree in bud configuration seen at apico- posterior segment of the left upper lobe, superior segment of the left lower lobe and lateral segment of left lower lobe. Superior ligular and middle lobe sub- segmental atelectasis.

These findings in correlation with lab investigations denotes rheumatoid interstitial fibrosis.



**Case (5)**

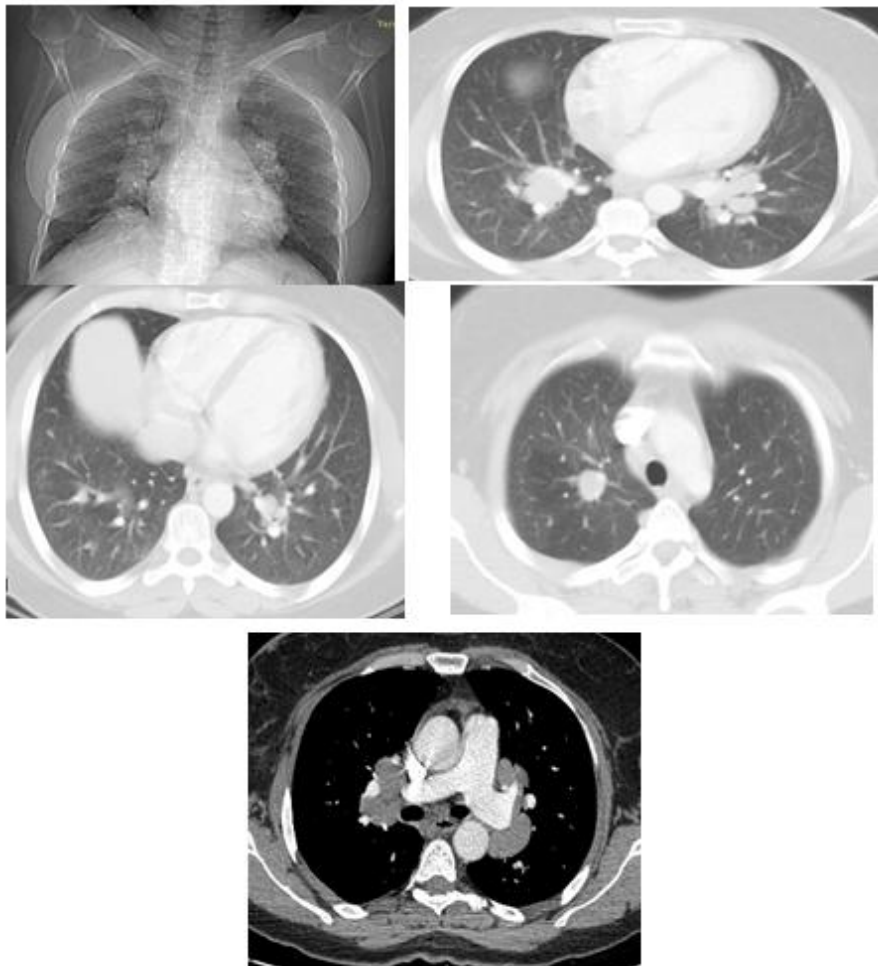
36 Year – old – female with history of sarcoidosis, presented with cough, fatigue and weight loss.

**HRCT shows**

Multiple variable sized pulmonary and pleural based pulmonary nodules , the largest on right side at anterior segment of right upper lung lobe measures about 2.1 x 1.7 cm with irregular margins, the largest on left side seen at lingual measures about 1.5 x 1 cm.

Bilateral multiple hilar lymph nodes, the largest on right side measures about 6.1 x 3.3 cm and on left side measures about 6.6 x 3.3 cm.

Multiple enlarged mediastinal lymph nodes, retrocaval, prevascular, pretracheal and subcarinal lymph nodes, the largest measures 1.6 x 1.5 cm.



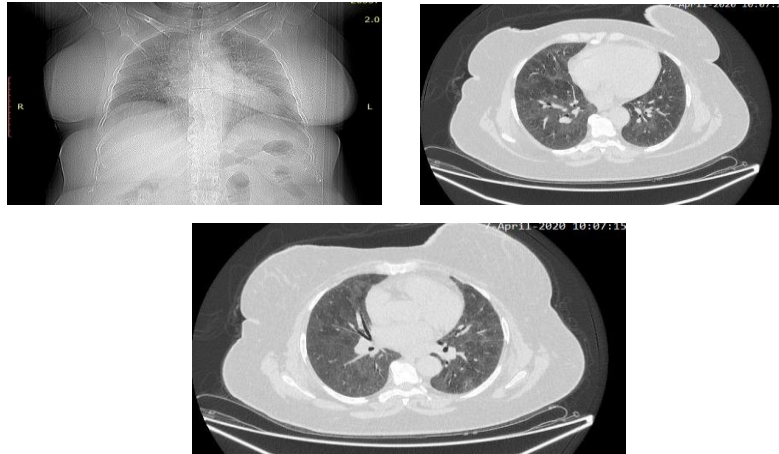
**Case (6)**

54 year- old- female with history of SLE presented with dyspnea.

**HRCT shows**

Both lungs show patchy ground glass opacification of intermelged with hyper and hypo attenuated areas of lung parenchyma giving mosaic appearance.

These findings denotes lung parenchymal changes of connective tissue disease in view of history



### Case (7)

76-year-old- male with history of RA presented with cough and dyspnea

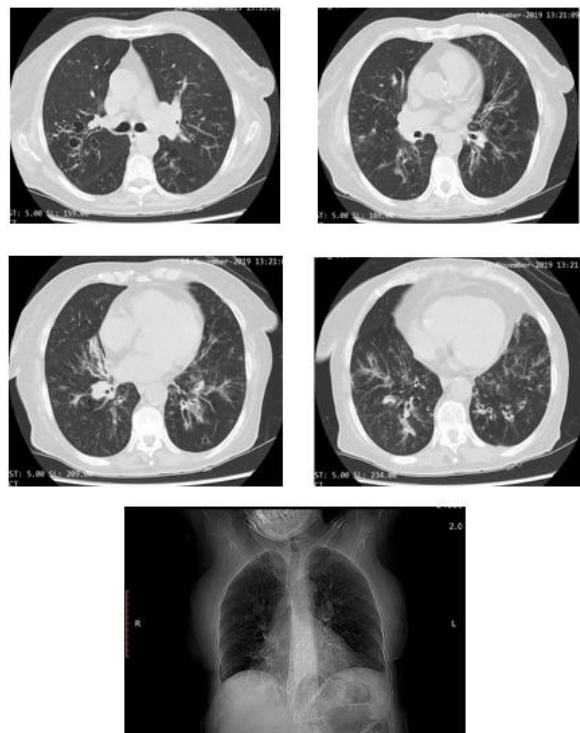
HRCT shows

Well inflated both lung lobes with bilateral bronchiectatic changes.

Centri-lobular nodules some of them give tree in bud appearance.

Multiple small ground glass patches and consolidation with air bronchogram seen within more on right lower lung lobe.

These findings in view of history and lab investigations denotes rheumatoid lung parenchymal changes





#### 4. DISCUSSION

Resistant framework ailments are those in which the body is attacked by its have specific flexible secure response. In commonplace, strong states, the secure system incites resistance, which may be a require of an anti-self-safe response. In any case, with autoimmunity, there's an incident of safe flexibility, and the rebellious competent for safe framework illnesses join sort II, III, and IV sensitivity reactions. Resistant framework diseases can have a combination of mixed side impacts that flare up and disappear, making assurance troublesome [7].

This cross-sectional review think about was done on 25 patients (19 rheumatoid speaking to 76%, 5 SLE speaking to 20%, 1 Sarcoidosis speaking to 4%) found that immune system infections were more common in female than male with 72 % in female and 28% in male. This result is about comparable to Zahra Mirfeizi, Donya Farrokh, Aida Javanbakht think about, et al [8] in which the predominance was 78% in female.

The mean age in this study is  $60.6 \pm 15.2$  which is about comparative to the think about of Abdel Moneim Medhat Elemery , et al in which the cruel age is 55. [9] but distinctive from that of the consider of Zahra Mirfeizi, et al. [8]. The cruel illness term in this consider is  $7.52 \pm 3.48$  which is about comparable to that of Marie Doualla-Bija, et al [10] in which the cruel length of CTD was  $10.1 \pm 6.6$  years. Infections of connective tissue can lead to pneumonic parenchymal association also pleural and vascular anomalies because of immune system forms

The SLE and rheumatoid joint torment (RA) were the preeminent visit sorts of CTD [11]. In these maladies, disarranges of the lung can increase horribleness and mortality [12]. For closeness and degree of parenchymal and pleural peculiarities assessment, HRCT has been showed up to be more pleasing than radiography. The imaging strategy of choice for assessment of patients with maladies of connective tissue is HRCT, illustrating the nearness, dispersion, and net characteristics of pneumonic malady with more noteworthy affectability than routine chest radiographs. In specific clinical situations, discoveries of HRCT can recommend a certain demonstrative procedure [13].

The RA is the foremost prevalent sort of CTD, influencing approximately 1% of individuals around the world. The recurrence of aspiratory

anomalies presented in affiliation with RA has been appeared to differ broadly. Pleural association, either pleural emission manifestation of RA [14].

Reticular and straight opacities are among the foremost critical CT discoveries in connective tissue malady. Reticular design speaks to the interlobular interstitium thickening inside the auxiliary aspiratory lobule. In conclusion arrange malady, honeycomb design may be seen and speaks to terminal lung infection. Other designs of pneumonic association incorporate nodular opacities, ground glass opacities, discuss space union and diminished lung mistiness such as in emphysema [15].

The foremost visit HRCT chest finding in immune system infections in this consider were ground glass murkiness comparative to the consider of Sathi N , et al. [16].

Mohd Noor et al. [17] ponder reticulation taken after by ground glass opacities was the foremost prevalent findings of HRCT [18]. And diverse too from that of consider of Tanaka et al. reticulation (98%) and Ground Glass mistiness (91%) is the foremost common CT finding taken after by footing bronchiectasis (75%), structural mutilation (62%) and nectar combing (60%) [19]. These contrasts may be due to variable ethnicity, infection movement and term of infection in cases.

The most x ray chest finding in rheumatoid arthritis is reticulo-nodular pattern representing 28% Sarcoidosis is a multisystem disease. The most prevalent presentation is thoracic involvement, which comprise the majority of symptoms. In sarcoidosis the most common findings of HRCT involve : interstitial lung disease, bilateral and mediastinal hilar lymphadenopathy; [20] Chest radiographs reveal bilateral hilar lymphadenopathy in 50% to 80% of cases and may illustrate a pulmonary parenchymal abnormalities range involving reticulonodular opacities, ground-glass changes, macronodules (often with a peribronchovascular distribution), micronodules (often with a perilymphatic distribution), and pulmonary fibrosis [21].

In this study x ray of sarcoidosis shows bilateral hilar lymphadenopathy (100%) which is similar to that of the study of Ketaki Utpat, Chinnu Sasikumar, Unnati Desai, et al in which 95% of cases shows bilateral hilar lymphadenopathy [22].

In our study the most common radiological finding in x- ray in autoimmune patients is reticulonodular pattern representing (36%) which is similar to the study of Areca Wangnoo , et al in which reticulonodular pattern is the most common finding in chest x – ray representing 39.3% [23,24].

In this research, we discovered that ESR was linked with pulmonary parenchymal lesions, ESR positive patients were more likely to pulmonary parenchymal lesions development which is similar to the study of Ping Li , et al. [25].

In this study there was 25 cases (100%) with positive HRCT chest findings while 13 cases (52%) only with positive finding in CXR which is different from the results of the study of Fenlon et al. in which about 70% of the patients have HRCT chest findings compared with only about 24% of the patients having CXR findings [26].

The sensitivity of HRCT in this study representing 100% which is nearly similar to the study of RuiQiang Xin, et al in which sensitivity of HRCT representing 90% [27].

## 5. CONCLUSION

It is concluded that HRCT is the imaging technique of choice), According to HRCT, ground glass opacities was the most prevalent chest findings representing 56%, followed by consolidation and bronchiectasis representing 28% and lastly pericardial effusion represents 4%.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

- Ozkaya S, Bilgin S, Hamsici S, Findik S. The pulmonary radiologic findings of rheumatoid arthritis. *Respiratory Medicine CME*. 2011;4(4):187-92.
- Sevket Ozkaya, Salih BilgSLEin ,Semra Hamisci,etal: The Pulmonary radiologic findings of rheumatoid arthritis, *Respiratory Medicine CME*. 2011;4(4):187-192.
- D.A. Ozerkis, J. Evans, A. Rubinowitz, et al: Pulmonary manifestations of rheumatoid arthritis, *Clin Chest Med*. 2010;451-458.
- Ping Li, Shenghong Li, Lan Li, etal: Chest CT findings in systemic lupus erythematosus and its correlation with serum markers, *Radiology of Infectious Diseases*. 2017;4(1):7- 13.
- D.L. Kamen, C. Strange: Pulmonary manifestations of systemic lupus erythematosus, *Clin Chest Med*. 2010;479-488.
- Santiago Martínez-Jiménez, Melissa L. Rosado-de-Christenson, Brett W. Carter: HRCT chest, *Radiopedia, Specialty Imaging: HRCT of the Lung E-Book*; 2017. ISBN: 978032352495, 2017.
- Nina Parker , Mark Schneegurt, Anh-Hue Thi Tu, et al. *Autoimmune disorders, Microbiology*; 2016.
- Mirfeizi Z, Farrokh D, Javanbakht A, Raufi E. Chest high resolution computed tomography findings in connective tissue diseases. *Tanaffos*. 2013;12(3):49–52.
- Abdel Moneim Medhat Elemary, Wael M. Elshawaf, Saad Mahmoud Motawea, et al. Predictors of airway and parenchymal lung abnormalities in patients with rheumatoid arthritis, *The Egyptian Rheumatologist*. 2021;43(2):125-130.
- Doualla-Bija M, Mbatchou Ngahane BH, Lucien KAD, et al. Pleuropulmonary Involvement in Connective Tissue Disorders in A Tertiary Care Hospital in Africa. *Int J Musculoskelet Disord: IJMD-101*; 2018.
- Bouros D, Pneumatikos I, Tzouveleki A. Pleural involvement in systemic autoimmune disorders. *Respiration*. 2008; 75(4):361–71
- Woodhead F, Wells AU, Desai SR. Pulmonary complications of connective tissue diseases. *Clin Chest Med*. 2008; 29(1):149–64
- Mayberry JP, Primack SL, Müller NL. Thoracic manifestations of systemic autoimmune diseases: radiographic and high-resolution CT findings. *Radiographics*. 2000;20(6):1623–35
- Woodhead F, Wells AU, Desai SR. Pulmonary complications of connective

- tissue diseases, Clin Chest Med. 2008;29(1):149-64, vii
15. Cozier YC. Assessing the worldwide epidemiology of sarcoidosis: challenges and future directions. Eur Respir J. 2016;48(6):1545-1548
  16. Sathi N, Urwin T, Desmond S, Dawson JK. Patients with limited rheumatoid arthritis-related interstitial lung disease have a better prognosis than those with extensive disease. Rheumatology (Oxford). 2011;50(3):620-2
  17. Mohd Noor N, Mohd Shahrir MS, Shahid MS, et al. Clinical and high resolution computed tomography characteristics of patients with rheumatoid arthritis lung disease, Int J Rheum Dis. 2009;12(2):136-44.
  18. Mohd Noor N, Mohd Shahrir MS, Shahid MS, et al. Clinical and high resolution computed tomography characteristics of patients with rheumatoid arthritis lung disease, Int J Rheum Dis. 2009;12(2):136-44.
  19. Tins BJ, Butler R, Imaging in rheumatology: reconciling radiology and rheumatology, Insights Imaging. 2013;4(6): 799-810.
  20. Dhagat PK, Singh S. et al. Thoracic Sarcoidosis: Imaging with High Resolution Computed Tomography. Journal of Clinical and Diagnostic Research : JCDR. 2017;11(2):TC15–TC18.
  21. Dhakshinamoorthy Ganeshan , Christine O. Menias, Meghan G. Lubner, et al. Sarcoidosis from Head to Toe: What the Radiologist Needs to Know, Radiographics. 2018;38:4
  22. Ketaki Utpat, Chinnu Sasikumar, Unnati Desai, et al. Sarcoidosis at the Pulmonary Medicine Department of a tertiary care hospital in Mumbai. Our experience and The New Modified Criteria Clinical Radiological Physiological (TNMC CRP) score for sarcoidosis: A novel proposition to assess the functional status, Monaldi, Archives for chest diseases. 2021;91:1.
  23. Wangnoo A, Banotra P, Sharma M, et al. HRCT Chest Findings in Patients with Rheumatoid Arthritis Associated-Interstitial Lung Disease (RA-ILD), Journal of medical science and clinical research. 2020;08(04):523-529.
  24. Y. Zhang, H. Li, N. Wu, et al. Retrospective study of the clinical characteristics and risk factors of rheumatoid arthritis-associated interstitial lung disease, Clin Rheumatol. 2017;36(4): 817-823.
  25. Ping Li, Shenghong Li, Lan Li, et al. Chest CT findings in systemic lupus erythematosus and its correlation with serum markers, Radiology of Infectious Diseases. 207;4(1):7-13.
  26. Fenlon HM, Doran M, Sant SM, et al. HIGH-resolution chest CT in systemic lupus erythematosus, AJR Am J Roentgenol. 1996;166(2):301-7.
  27. Xin R, Zhang S, Peng R. A Retrospective Study on Clinical Characteristics of Patients with Rheumatoid Arthritis-Interstitial Lung Disease Based on Chest CT Scan. Revista Argentina de Clínica Psicológica. 2020;29(4):877-882.

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