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"ROLE OF HIGH RESOLUTION COMPUTED TOMOGRAPHY (HRCT) FOR THE EVALUATION OF LUNG PARENCHYMA IN PATIENTS WITH ARTHRITIS"

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ABSTRACT

Background:

Rheumatoid arthritis is a chronic disorder that not only causes joint damage but also affects the heart and lungs. Computed tomography is of high repute for evaluating lung parenchyma in patients with rheumatoid arthritis. These manifestations lung parenchymal disease like pleural effusion, lung nodules, fibrosis, alveolitis, and bronchiectasis is a major contributor to morbidity and mortality. In 67% of patients with RA, lung involvement has been reported that could involve pleura, airways, and lung parenchyma.

Methodology:

In this descriptive study, 30 patients of rheumatoid arthritis were selected with age and gender discrimination by convenient sampling, at Department of Radiology, Al Razi health care, The Diagnostic center Lahore. 64 slices Computed Tomography Toshiba Asteion machine was used.

Results:

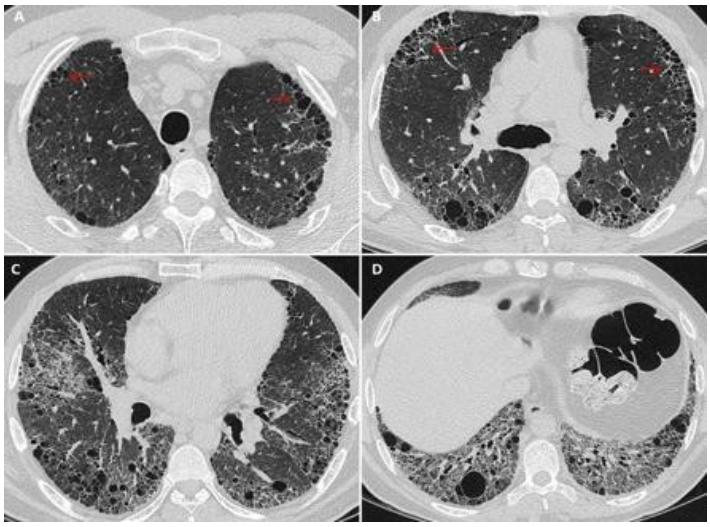
Out of 30 patients 14 (46.7%) were female and 16 were male. Bronchiectasis was most common finding found in 16 patients out of 30 patients. While honeycomb was less common and seen in only 8 patients. Chest discomfort was present in 16 patients and SOB was present in 14 patients. Ground glass opacities seen in 50 % patients. 12 % patients presented with pleural effusion and 15 % patients showed enlarge lymph nodes.

Keywords:

Rheumatoid arthritis, Lungs, High-resolution computed tomography of the chest, Lung function tests

INTRODUCTION

Worldwide, annual incidence of rheumatoid arthritis is approximately 3 cases per 10,000 population, and prevalence rate is approximately 1%. The prevalence of rheumatoid arthritis in Pakistan is 0.5%. Rheumatoid arthritis is two to three times more common in women than in men. The lungs are pair of spongy, air-filled organs located on either side of the chest (thorax). The trachea conducts inhaled air into lungs through bronchi. The bronchi then divided into bronchioles, finally becoming microscopic. In alveoli, oxygen from the air is absorbed into blood. Carbon dioxide, a waste product of metabolism, travels from blood to alveoli, where it can be exhaled. [(1)]



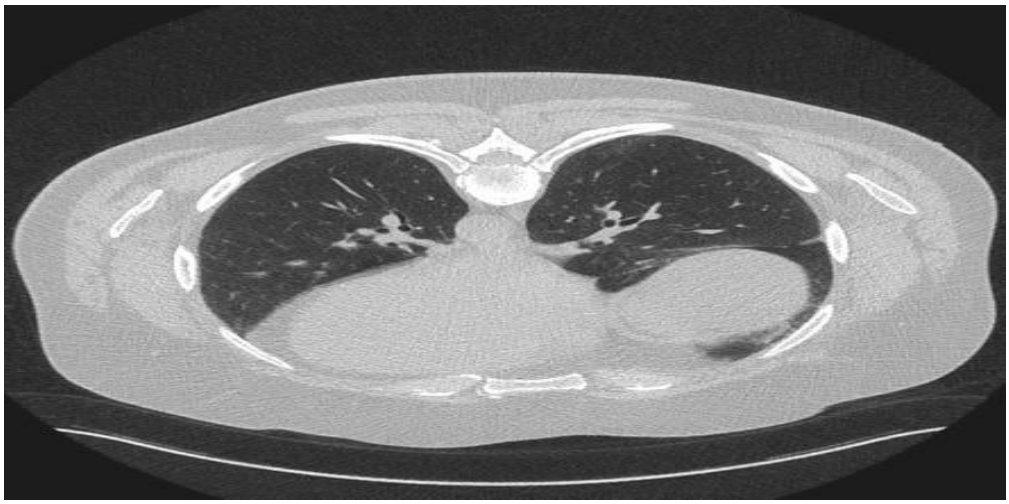
HRCT of RA patients

Rheumatoid arthritis (RA) is an autoimmune disease in which body's own immune system which normally protects it from foreign objects like bacteria and viruses mistakenly attacks the joints. This results in inflammation that causes the synovium to thicken, resulting in swelling and pain in and around the joints. The synovium makes a fluid that lubricates joints and helps them move smoothly. If inflammation is not checked, it can damage the cartilage, elastic tissue that covers the ends of bones in joint, as well as the bones themselves. Over time, cartilage is lost, and the joint spacing between bones becomes smaller. Joints can become unstable, painful and lose their motion. Joint deformity also can occur. Joint damage is irreversible so doctors recommend early diagnosis and aggressive treatment to control RA.[(2)]

Rheumatoid arthritis most commonly affects joints of hands, feet, wrists, elbows, knees and ankles. The joint effect is usually symmetrical. Symmetrical means if one knee or hand if affected, usually the other one is also affected. Because rheumatoid arthritis also affects body systems, such as the cardiovascular or respiratory systems, it is called a systemic disease. Systemic means "entire body." Rheumatoid arthritis causes joint pain, tenderness, swelling or stiffness for six weeks or longer. In rheumatoid arthritis mostly small joints are affected. In rheumatoid arthritis many people experience fatigue, loss of appetite and a low-grade fever. Rheumatoid arthritis causes scarring within lungs and it cause shortness of breath, a chronic dry cough, fatigue, weakness and loss of appetite. Small lumps formed in the lungs which is called as rheumatoid nodules. Lung nodules remain asymptomatic, however, sometimes a nodule can rupture and cause a collapsed lung. RA also causes pleural effusion. Sometimes it resolves on its own. It cause shortness of breath, fever and pain on breathing.

High-resolutions Computed Tomography (HRCT) is a frequently used non-invasive 3D imaging and analysis technique for the investigation of lung parenchyma and interstitium. This technology has improved the diagnostic capabilities in the field of health science research. The demands of this technique are increasing day by day. One of the main advantages of this technique is the fact that it is an non-invasive characterization technique which allows 3D monitoring of internal structural changes at

resolutions down to a few hundred nanometers.



NORMAL HRCT

On HRCT rheumatoid arthritis in lungs gives ground glass opacities and interstitial fibrosis. On HRCT basic four patterns are usual interstitial pneumonia, nonspecific interstitial pneumonia, organizing pneumonia and bronchiolitis. Other than these four patterns reticulation is common in it. Pleural effusion is also seen on HRCT in patients with rheumatoid arthritis. Large rheumatoid nodules can be single or multiple, they tend to be based peripherally. Cavitation of peripheral nodule can lead to pneumothorax and hydro pneumothorax. Other features of rheumatoid arthritis involving lungs are bronchiectasis, small centrilobular nodules or tree-in bud appearance, bronchiolitis obliterans, folicular bronchiolitis and Caplan syndrome. These are rare features. HRCT is more sensitive than standard chest radiography and is highly specific in predicting the extent and severity of changes of lung parenchyma. Hence with the advent of HRCT in diagnosing changes in the lung parenchyma, morbidity and mortality can be reduce in general population.[5]

Pulmonary involvement is a frequent extra articular manifestation of rheumatoid arthritis (RA) and might be the second most frequent cause of death, after infection. Interstitial lung disease (ILD) and subclinical alveolitis have been found in up to 40% of RA patients. In general, ILD is seen more frequently in men than women, in the presence of high rheumatoid factor (RF) titers, and in the setting of more severe articular disease. It is often a progressive disease which may result in disabling symptoms and respiratory failure.

Radiographically, the pulmonary changes seen in RA are indistinguishable from those seen with idiopathic pulmonary fibrosis or ILD associated with other connective tissue disease. Although ILD is a well-known manifestation of RA, small airway involvement may be the most common form of RA lung involvement. Apart from pulmonary function tests (PFTs), other noninvasive tools such as high resolution computed tomography **(**HCRT) of the lungs are more sensitive in the assessment of rheumatoid lung disease.

This prospective study aimed to assess by HCRT and PFT the frequency and predictive factors of pulmonary involvement in unselected RA patients. We noted the duration of RA, extrarticular

complications, duration of early-morning joint stiffness, current and previous disease-modifying ant rheumatic drugs (DMARDs), and corticosteroid use.

Patients were asked about cough, dyspnea, sputum production, chest pain, weight loss, alcohol habits, previous chest disease, and risk factors for respiratory disease such as smoking, drugs, domestic pets, and occupation. Current smokers were those who had smoked more than five cigarettes a day during the previous 6 months; nonsmokers had smoked less than 20 packets of cigarettes during their lifetimes. All patients had venous blood taken for full blood count, erythrocyte sedimentation rate (ESR), renal and liver function, C-reactive protein (CRP), and plasma proteins.

Immunological investigations included RF, anti-nuclear antibodies (ANA), and human leukocyte antigen (HLA)-DR1 and -DR4 genotypes. The latter genotypes were determined by polymerase chain reaction restriction fragment length polymorphism.

All patients underwent chest radiography, HRCT, and full PFTs. After being informed about the objective, all gave their informed consent. Pulmonary function testing and HRCT scans were always performed less than a week apart. Radiographs of the hand were performed to calculate Larsen's scores. Carbon monoxide diffusion capacity was not assessed in our patients because of technical limitations. The patients were examined for the presence of extra-articular manifestations (e.g., vasculitis, nodules).

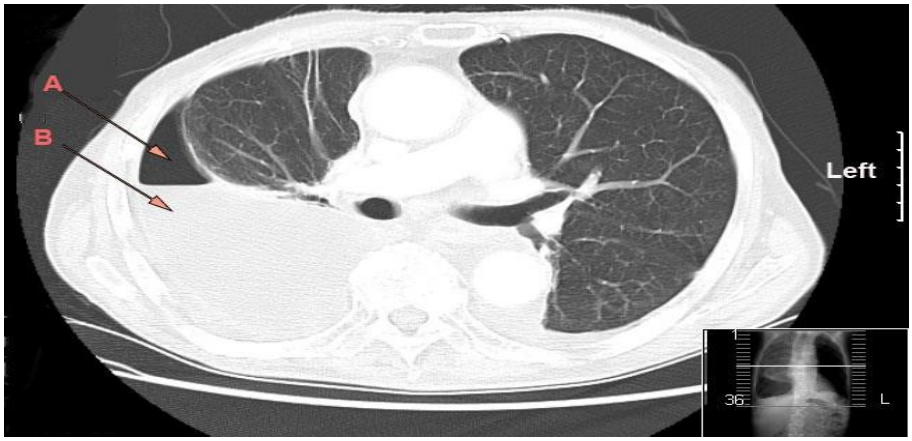
In the absence of clinical information, the HRCT examinations were interpreted by two experienced radiologists and the decision was obtained by consensus. Ritchie articular index, pain score, and morning stiffness duration. Extra-articular manifestations showed no relationship with HRCT findings and were demonstrated by only three patients in our study. The PFTs results did not correlate to disease duration or serological disease activity parameters including ESR, CRP, and pain score.

Rheumatoid arthritis (RA) can affect the lungs in different manners, with interstitial lung disease (ILD) as the most serious manifestation. Although lung and joint compromise could be thought to evolve in parallel, there are data suggesting the opposite? In this study, we evaluated the relationship between lung and joint involvement in RA ILD. Methods: An observational cross-sectional study of RA ILD patients evaluated from January 2013 to February 2017. Joint disease assessment included number of tender and swollen joints, patient's global assessment of disease activity, erythrocyte sedimentation rate(ESR) or C-reactive protein, and disease activity score (DAS28). Lung disease assessment included forced vital capacity, diffusion capacity (DLCO), and Goh high-resolution computed tomography (HRCT) score for total extent, ground glass, and reticular pattern.

A detailed high-resolution CT (HRCT) scoring system includes assessment of scan quality, presence and extent (to nearest 10%) of disease features, overall extent of fibrosis to nearest 10%, HRCT distribution and HRCT pattern. QCT using DTA is used to detect regions of lung fibrosis and quantify extent. First order pixel statistics are calculated within regions classified as fibrotic by DTA. We compared DTA fibrosis extent scores with visually estimated extent of fibrosis and with pulmonary function tests. We used Receiver Operating Characteristics (ROC) and logistic regression to evaluate the ability of QCT measures to distinguish UIP from other patterns of RAILD.

Diffuse lung diseases describe a heterogeneous group of disorders of the lower respiratory tract characterized by inflammation and derangement of the interstitium and loss of functional alveolar units. The disease is not restricted to the interstitial only, as it involves epithelial, endothelial and mesenchymal cells with the disease process extending into the alveoli, acini and bronchioles. Thus, the entire pulmonary parenchyma is involved. The objective of the study was to evaluate diffuse lung diseases by high resolution computed tomography of chest.

The disorders in this heterogeneous group are classified together because of similar clinical, roentgen graphic, for detection of early or mild infiltrative lung disease, HRCT is clearly more sensitive than the chest radiograph. However, in the early stages of any lung disease, including IPF, the degree of parenchymal infiltration may be too slight to cause any CT abnormality.

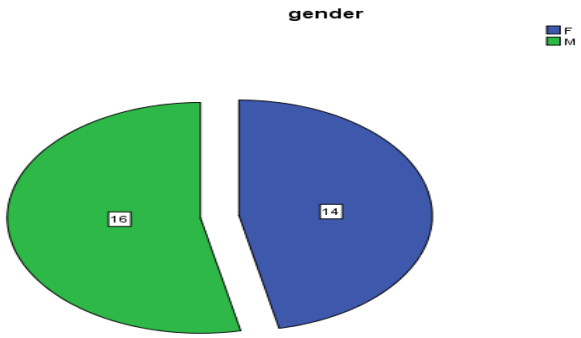


PLEURAL EMPHYSEM

RESULTS

Out of 30 patients 14 were female patients and 16 were male patients. All patients were of rheumatoid arthritis patients. 15 patients presented with ground glass opacities. 16 patients presented with bronchiectasis. 12 patients presented with pleural effusion. 15 patients presented with enlarged lymph nodes. 8 patients presented with honeycomb appearance.

Frequency distribution of gender



	Frequency	Percent
F	14	46.7
M	16	53.3
Total	30	100.0

Table 1 shows out of 30 patients 14 were female (46.7%) while 16 were male (53.3%)

Joint stiffness

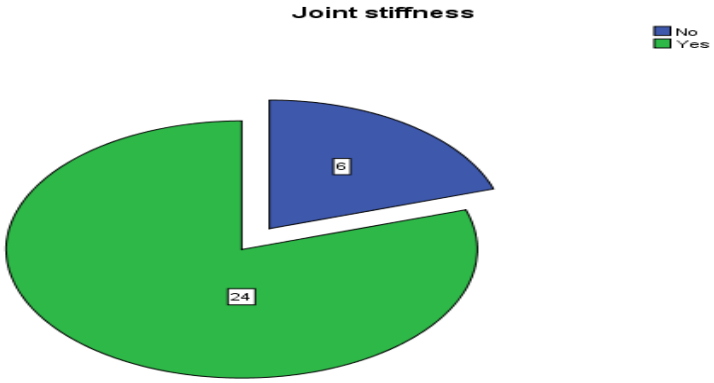


Table: 2 Frequency distribution of joint stiffness

	Frequency	Percent
No	6	20.0
Yes	24	80.0
Total	30	100.0

Table 2 shows out of 30 patients 24 (80%) patients had joint stiffness.

Chest discomfort

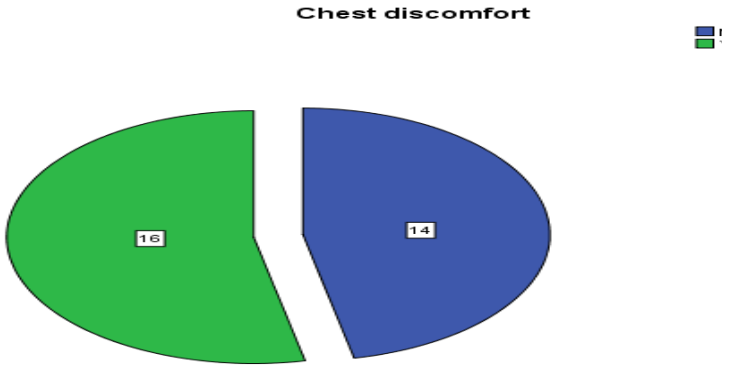


Table: 3 Frequency distribution of chest discomfort

	Frequency	Percent
No	14	46.7
Yes	16	53.3
Total	30	100.0

Table 3 shows out of 30 patients 16 (53.3%) patients had chest discomfort

Shortness of breath

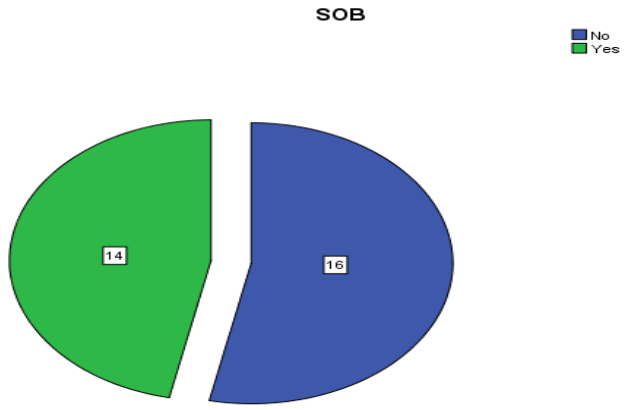


Table: 4 Frequency distribution of shortness of breath

	Frequency	Percent
No	16	53.3
Yes	14	46.7
Total	30	100.0

Table 4 shows 46.7% patients presented with SOB

GROUND GLASS OPACITIES:

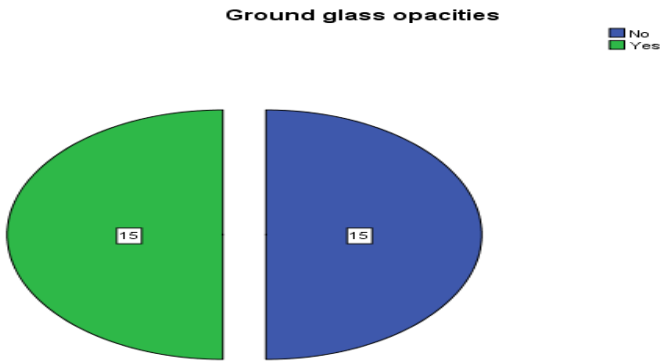


Table: 5 Frequency distribution of ground glass opacity

	Frequency	Percent
No	15	50.0
Yes	15	50.0
Total	30	100.0

Out of 30 patients 15 patients presented with ground glass opacity

JOINT SWELLING:

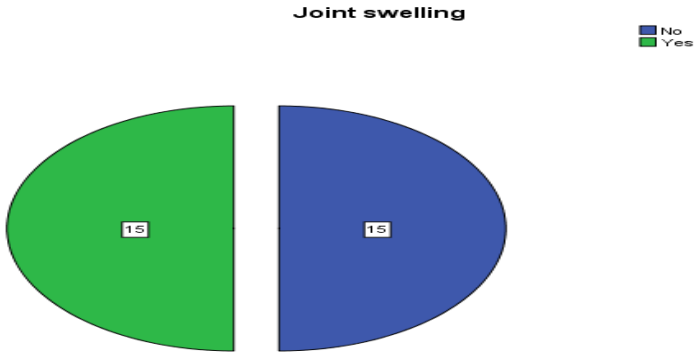


Table 6 Frequency distribution of joint swelling

	Frequency	Percent
No	15	50.0
Yes	15	50.0
Total	30	100.0

Out of 30 patients 50% patients presented with joint swelling

BRONCHIECTASIS:

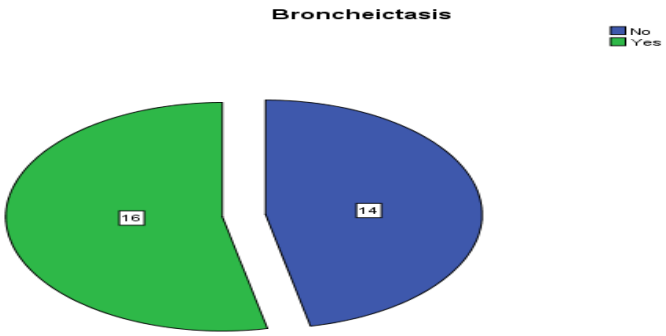


Table 7Frequency distribution of bronchiectasis

	Frequency	Percent
No	14	46.7
Yes	16	53.3
Total	30	100.0

Table 7 shows out of 30 patients 16 (53.3%) patients had bronchiectasis

PLEURAL EFFUSION:

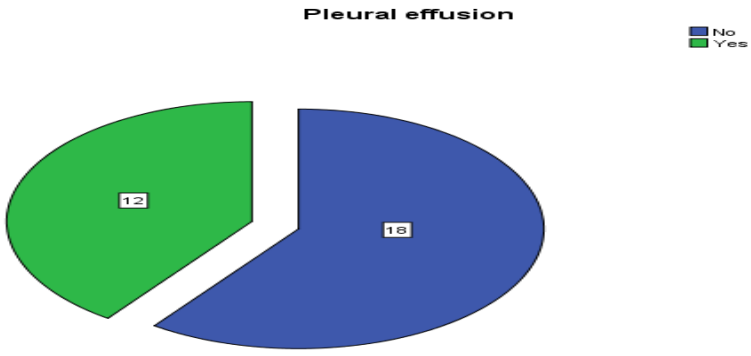


Table: 8 **Frequency distribution of pleural effusion**

	Frequency	Percent
No	18	60.0
Yes	12	40.0
Total	30	100.0

Table no 8 Out 30 patients only 12 patients had pleural effusion

ENLARGED LYMPHNODES:

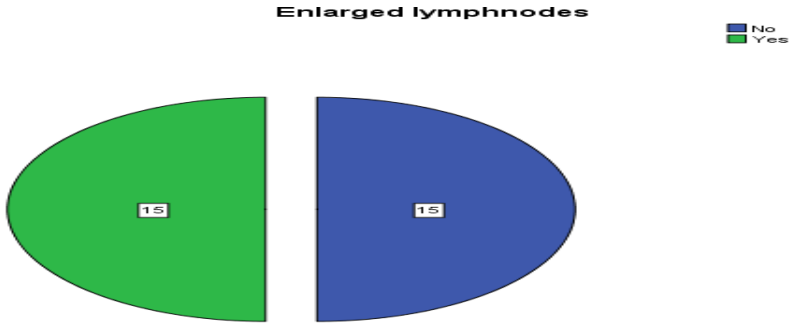


Table 9 Frequency distribution of enlarged lymph nodes

	Frequency	Percent
No	15	50.0
Yes	15	50.0
Total	30	100.0

Table 9 shows out of 30 patients 50% patients had enlarged lymph nodes

HONEY COMB APPERANCE:

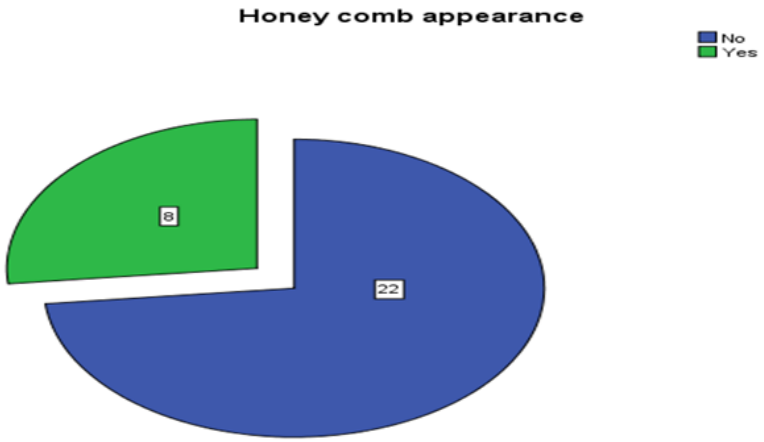


Table: 10 Frequency distribution of honey comb appearance

	Frequency	Percent
No	22	73.3
Yes	8	26.7
Total	30	100.0

Table no 10 shows Out of 30 patients only 8 patients showed honeycomb appearance

Enlarged lymph nodes

Table: 11 Frequency distribution of Gender*Enlarged lymph nodes Cross tabulation

			Enlarged lymph nodes		
			No	Yes	Total
gender	F	Count	5	9	14
		% within gender	35.7%	64.3%	100.0%
	M	Count	10	6	16
		% within gender	62.5%	37.5%	100.0%
Total		Count	15	15	30
		% within gender	50.0%	50.0%	100.0%

It shows out of 11 female 9 (64.3%) had enlarged lymph nodes and out of 16 male 6 (37.5%) had enlarged lymph node

Table 12 Frequency distribution of Gender * Bronchiectasis Cross tabulation

			Bronchiectasis		
			No	Yes	Total
gender	F	Count	9	5	14
		% within gender	64.3%	35.7%	100.0%
	M	Count	5	11	16
		% within gender	31.3%	68.8%	100.0%
Total		Count	14	16	30
		% within gender	46.7%	53.3%	100.0%

It shows out of 30 patients 5 (35.7%) were female while 11 (68.8%) male had bronchiectasis

Table 13Frequency distribution of Gender*Pleural effusion Cross tabulation

			Pleural effusion		
			No	Yes	Total
gender	F	Count	10	4	14
		% within gender	71.4%	28.6%	100.0%
	M	Count	8	8	16
		% within gender	50.0%	50.0%	100.0%
Total		Count	18	12	30
		% within gender	60.0%	40.0%	100.0%

It shows out of 14 female only 4 (28.6%) had pleural effusion and out of 16 male 8 (50%) had pleural effusion

DISCUSSION

The current study was designed to identify the role of HRCT for lung parenchyma in patient with arthritis. Out of 30 patients 14 were female patients and 16 were male patients. 50% patients presented with ground glass opacities. 16 patients presented with bronchiectasis. 40% patients presented with pleural effusion. 15 patients presented with enlarged lymph nodes. 26.7% patients presented with honeycomb appearance. B costed conducted a study in 1995 to determine the HRCT used in patient with arthritis .the most frequent abnormalities observed in 77 RA patient were bronchiectasis 30% (n=23) ground-glass opacities (n=11) 17% honeycombing (n=8)10% were diagnosed out of 77 patient in our study determined the symptoms out of 3o patient were bronchiectasis 53.3% ground-glass opacities 50% and honeycombing 26.7% according to our study male patient more affecter than females.

Another study was conducted by J Medonag et al, they performed HRCT on lungs of 20 RA patient HRCT is a proven standard in ILD patient 16 patient have fibrosis. 4 have ILD positive while other 4 bronchiectasis and 7 have pleural involvement. They had a small sample size as compared to us they reported that 4% bronchiectasis and 7% pleural involvement in RA patient. In our study 53.3% patient were bronchiectasis and 10% patient have pleural effusion. Muller et al 2014 wrapped up the bilateral parenchymal mixes from the standard that were seen in fifteen cases. Basal and sub pleural disengage was found in 13 cases. Honeycombing and septal lines were found in eight cases each. Bronchiectasis was found in seven cases, and ground glass absence of definition was found in four cases while sub pleural irritates were open in two cases. HRCT findings were available in all the 16 cases. In our study our sample size is larger. In our study 26.7% patients had honeycomb appearance, 40% patients had pleural effusion, 50% had ground glass opacities and 53.3% had bronchiectasis.

Conclusion:

It is concluded that HRCT images are beneficial in diagnosing interstitial lung disease for rheumatoid arthritis patients. This modality may use for reticular pulmonary opacification, with a predominance in the middle to upper lung fields in future research study.

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3. @Republications; Support statement: JJ. Swigris is supported in part by a Career Development Award from the National Institutes ofHealth, (K23 HL092227). Conflict of interest: Disclosures can be found alongside the online version of this article at erj.ersjournals.com in rheumatoid arthritis associated interstitial lung disease, physiology, and not HRCT pattern, predicts mortality

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