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Radiation Semiotics Of Interstitial Changes In The Lungs In Connective Tissue Diseases

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Abstract

This article explores the significance of radiation semiotics in diagnosing interstitial lung changes associated with connective tissue diseases (CTDs). Common histological interstitial lung lesions in CTD patients include ordinary, nonspecific, and lymphocytic interstitial pneumonia.
The article delves into the complex relationship between radiation semiotics and the manifestation of interstitial lung changes in CTD patients. It emphasizes the challenges of accurate diagnosis, early detection, and monitoring of these conditions, highlighting the crucial role of radiological methods in clinical practice.
Moreover, the article details the distinctive characteristics and radiological features of ordinary, nonspecific, and lymphocytic interstitial pneumonia in CTD patients, aiding differentiation for tailored treatment approaches.
In conclusion, this article underscores the importance of radiation semiotics in diagnosing and managing interstitial lung changes in CTD patients, fostering a deeper understanding of these conditions and facilitating precise clinical interventions. The integration of advanced imaging techniques and evolving semiotic approaches show promise in enhancing treatment outcomes and prognoses for CTD patients with interstitial lung diseases.

Keywords: idiopathic interstitial pneumonia, usual interstitial pneumonia, nonspecific interstitial pneumonia, lymphocytic interstitial pneumonia, ground glass, reticular changes, honeycomb lung.

INTRODUCTION

The relevance of the problem of diagnosis and differential diagnosis of interstitial lung diseases is caused by the variability of radiation semiotics of this pathology. To identify interstitial lung diseases, traditional X-ray examination is used, which has low sensitivity and specificity, as well as X-ray computed tomography using high-resolution added tomography techniques. For most primary care doctors and radiology doctors, interstitial lung diseases (ILD) traditionally cause particular difficulties in diagnosis (1,2,3,4). However, the prevalence of ILD is constantly increasing (5,6,7). The social significance of this pathology is due not only to the high cost of treatment but also to the economic damage due to persistent labor losses arising from the development of progressive respiratory failure in patients. Meanwhile, material losses caused by ILD can be reduced with timely diagnosis and adequate therapy.

In recent decades, there has been a change in the X-ray picture of interstitial processes associated with various factors: a large number of X-ray studies, polypromasia, the use of modern X-ray diagnostic methods that make it possible to determine previously unknown signs of PET-CT (8,9).

Knowledge of the features of modern radiation semiotics of interstitial lung diseases is necessary to interpret research data correctly.

The study aimed to identify radiological and computed tomography (CT) signs of interstitial lung disease in patients with connective tissue diseases.

MATERIALS AND METHODS

An extensive analysis of clinical, radiological, and computed tomographic data was carried out on 20 patients admitted to the Republican Scientific Center for Emergency Medical Care (RSCEM) in the therapeutic intensive care unit with shortness of breath, low-grade fever, and chest pain symptoms. All patients had a long history of connective tissue diseases, such as rheumatoid arthritis and systemic lupus erythematosus. All patients were hospitalized in the therapeutic intensive care unit. X-ray examination was performed using an Apelem apparatus.

Multislice computed tomography (MSCT) of the chest organs was performed using an AquilionPrime 160 MSCT device (CanonMedicaSystem). Radiological studies were compared with the clinical picture at various stages of the disease.

RESULTS

According to the data obtained, in the clinical picture of patients upon admission to the hospital, signs of respiratory failure predominated among all symptoms, which was manifested by increased heart rate, shortness of breath, cyanosis, and a compensatory increase in blood pressure.

In connection with developing the clinical picture, all patients underwent chest X-rays and MSCT. When analyzing radiographs, there was even a slight decrease in the transparency of the lung tissue asymmetry of the lung pattern.

Analyzing the nature of pathological shadows on the first day, subpleural areas of the collapse of the lung tissue above the diaphragm and a decrease in the transparency of the lung fields were identified. In three patients with rheumatoid arthritis (RA), upon admission, focal shadows of a confluent nature were determined, mainly in the peripheral zones (Table 1).

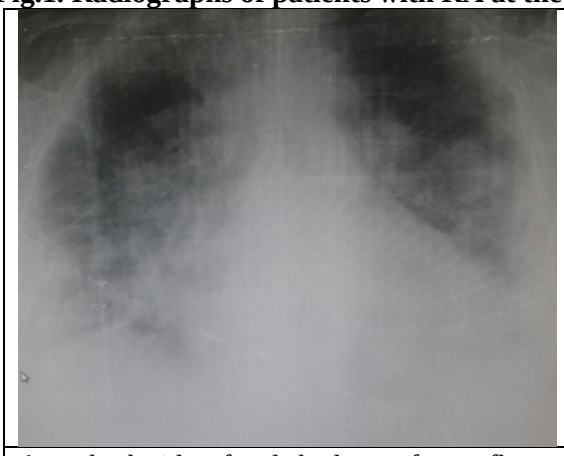
Upon admission to the hospital, patients with systemic lupus erythematosus (SLE) showed no reliable signs of pathological shadows in the lungs on a chest x-ray. In one patient (20%), rounding of the lateral sinuses on both sides was determined, indicating the presence of effusion in the pleural cavity.

In patients with RA, pathological changes upon admission to the hospital were more often localized in the middle and basal parts of the lungs. One patient with rheumatoid arthritis (RA) had diffuse changes in the lung tissue (14%). In most patients with RA, changes in the lung tissue were asymmetrical. In another patient with RA, foci and focal-focal shadows of a confluent nature were identified (Fig. 1). Moreover, these shadows were localized subpleural. In the basal regions, symmetrically on both sides, which is characteristic of pulmonary edema (non-cardiogenic pulmonary edema, acute respiratory distress syndrome) (Fig. 1). In most patients with RA, the shadows were of medium and high intensity. Linear subpleural clouds above the diaphragm, indicating discoid atelectasis, were characteristic in 85.7% of cases in patients with RA (Table 1)

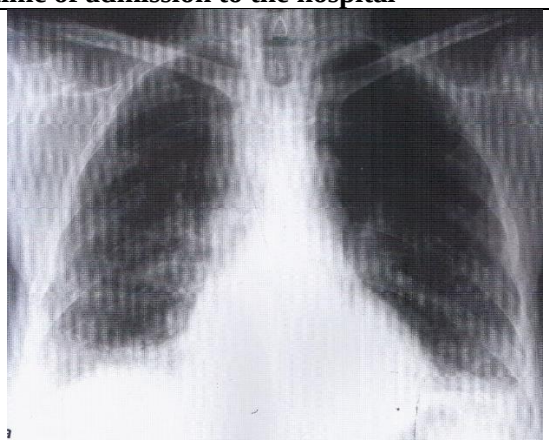
Table 1. Radiological signs in patients with RA at the time of admission to the hospital

Indicators		Patients with RA (n-10)	
		Abs.	Rel. (%)
Localization of changes	superior field	1	14
	middle-bottom field	5	71
	total	3	14
Symmetry	symmetrical	3	28,5
	Not symmetrical	7	71
outbreaks	outbreaks	3	14
	foci and focuses of a draining nature	3	14
Intensity	Low	1	14
	Average	9	85,7
	High	9	85,7
Linear subpleural shadows in the basal regions		7	85,7

Fig.1. Radiographs of patients with RA at the time of admission to the hospital



A. on both sides, focal shadows of a confluent nature, mainly subpleural



B. in the basal regions, there are linear shadows, deformation of the pulmonary pattern

Five patients with RA and patients with SLE (5 patients) underwent MSCT on the sixth day to clarify the diagnosis. In patients with SLE, interstitial thickening of the “ground glass” type was not detected. In patients with RA, the type of interstitial compaction of the “ground glass” type was determined in three types: uniform diffuse compaction, one patient, the type of uneven diffuse compaction, and the type of uneven focal compaction. In 66% of cases, the “ground glass” was asymmetrical, and in all cases, the process was localized mainly in the basal regions of the lungs. Peripheral reticular changes were detected in all cases with RA and SLE. Moreover, in patients with SLE, the process was localized in one lung and one patient in both lungs. In all patients with RA, reticular changes were visualized in both lungs.

Table 2. CT scans in examined patients in a comparative aspect

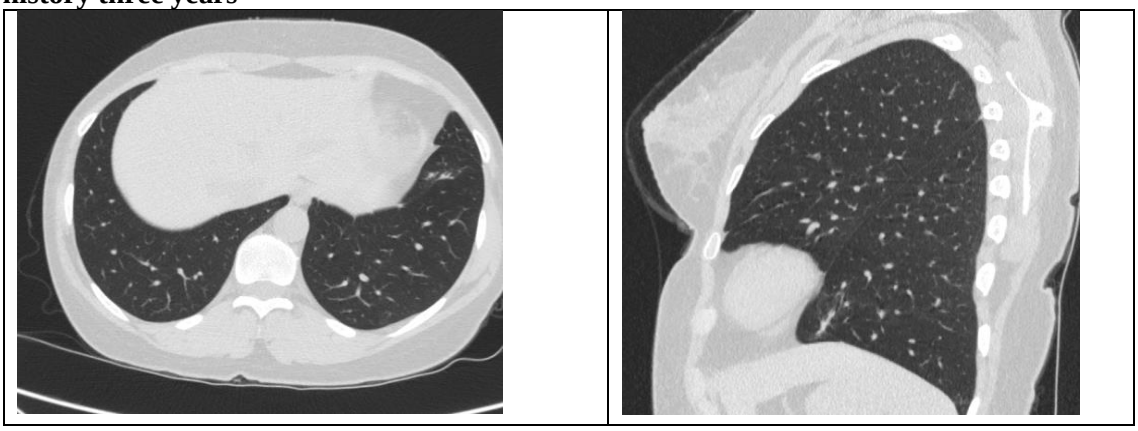
Indicators		RA (n-5)		SLE (n-5)	
		Abs	Rel. (%)	Abs	Rel. (%)
Ground glas opacity	uniform diffuse	1	33	0	0
	uneven diffuse	1	33	0	0
	uneven focal length (spotty)	3	33	0	0
Ground glas opacity symmetry	symmetrical	1	33	0	0
	Not symmetrical	4	66	0	0
Localization Ground glas opacity	Mainly in the basal regions	5	100	0	0
Reticular changes along the periphery due to thickening of intralobular and interlobular septa	in both lungs	5	100	2	50
	in one lung	0	0	3	50

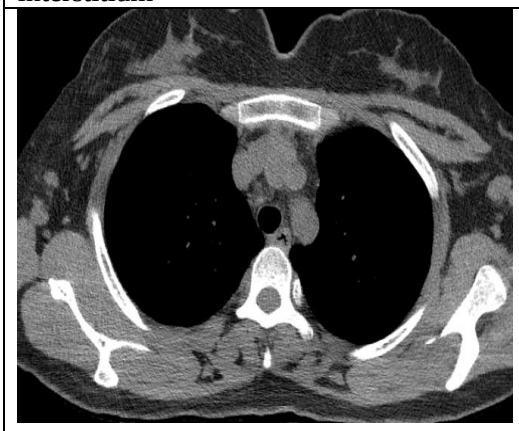
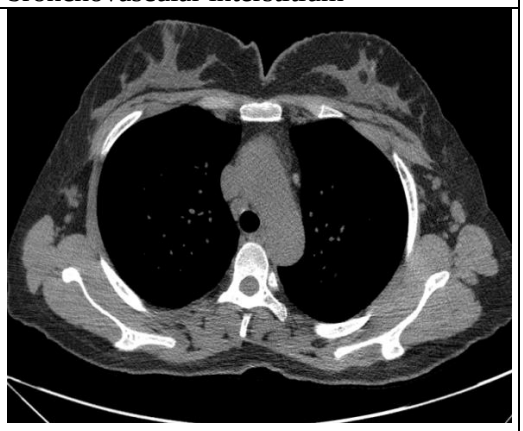
Table 3. CT scans in examined patients in a comparative aspect

Indicators		RA (n-5)		SLE (n-5)	
		Abs	Rel. (%)	Abs	Rel. (%)
Thickening of the peribronchovasal interstitium		5	100	2	100
bronchiectasis	traction	3	66	0	0
	varicose veins	3	66	0	0
	were not determined	0	0	5	100
Uneven ventilation of lung tissue with the presence of “air traps”	were not determined	4	66	0	0
	determined	1	33	0	0
"Interface" symptom	were not determined	0	0	5	100
	determined	5	100		
Thin-walled air cysts	were not determined	0	0	5	100
	determined	5	100	0	0
Pleural effusion	on both sides	3	33	1	50
	On the one side	1	33	0	0
	were not determined	1	33	1	1
Lymphadenopathy	intrathoracic lymph nodes	4	66	2	100
	axillary group	1	33	2	100

In patients with SLE, in addition to reticular changes, the following signs were determined: thickening of the peribronchovasal interstitium (100%), effusion in the pleural cavity on both sides in one patient, and enlargement of intrathoracic and axillary lymph nodes in all cases (Figure 2).

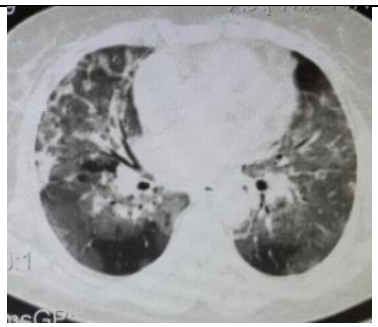
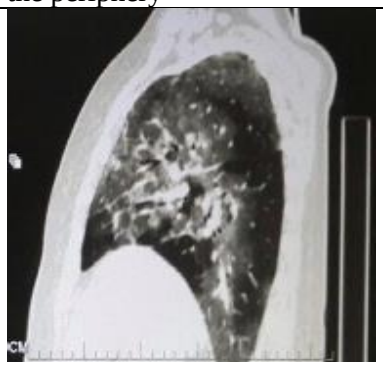
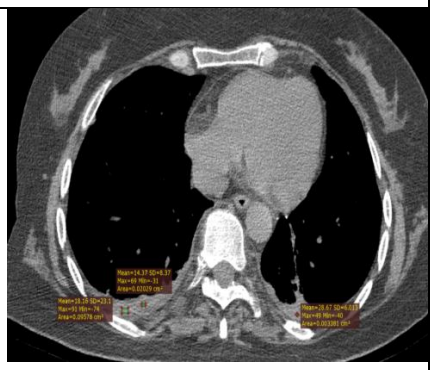
Figure. 2. a, b, c, d - MSCT followed by MPR reconstruction of patient B, 34 years old, with SLE, medical history three years



A. ax. project; in the lower lobe of the left lung, there is the thickening of the bronchovascular interstitium	B. ax. projection: in the lower lobe of the left lung (C8) thickening of the bronchovascular interstitium
	
C. coronal projection. lymphadenopathy of intrathoracic lymph nodes	D. ax. project: lymphadenopathy of the axillary group of the lymph node

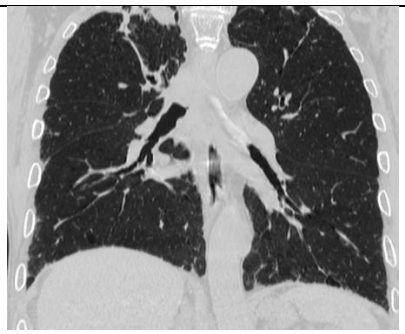
Thickening of the peribrochovasal interstitium was detected in all patients with RA and two with SLE. Three patients with RA (66%) had bronchiectasis, both traction and varicose veins. One patient with RA had uneven ventilation of the lung tissue in the form of "air traps" (Figure 3).

Figure 3. a, b, c, d, e, f - MSCT with subsequent MPR reconstruction of patient A., 54 years old, with RA

		
a. ax. project; uneven ventilation of lung tissue with the presence of "air traps"	b. ax. projection: "air traps" areas of alveolar consolidation along the periphery	c. ax. project; thickening of the bronchovascular interstitium.
		
d.coronary projection: thickening of the bronchovascular interstitium, air-containing cysts.	e. sag.project: "air traps", thickening of the bronchovascular interstitium, "interface" symptom	f. axial projection, mediastinal window: effusion in the pleural cavity on both sides

All patients with RA had thin-walled air bullae and the "interface" symptom (irregularity of the contour of the bronchovascular interstitium, barely noticeable short lines perpendicular to the interface between the air pulmonary parenchyma and the bronchi and vessels) (Figure 4). Pleural effusion was detected in two patients with RA, one on one side and the other on both sides (Table 3).

Figure 4. a, b, c, d, e, f - MSCT with subsequent MPR reconstruction of patient A., 54 years old, with RA

		
a. ax. projection: on both sides asymmetrically reticular changes in the periphery	b. ax. projection: air-containing cysts in the left lung	c. ax. project; thickening of the peribronchovasal interstitium
		
d. coronary projection: thickening of the peribronchovasal interstitium, traction bronchiectasis	e. axial projection: asymmetrical zones of fibrosis in both lungs	f. sag.project: lymphadenopathy of the intrathoracic lymph nodes

CONCLUSION

1. X-ray signs of lung damage in patients with rheumatoid arthritis are symmetrical or asymmetrical damage, focal or diffuse "ground glass," uneven ventilation of the lung tissue in the form of "air traps," "interface" symptom, air-containing cysts, pleural effusion cavities on both sides, lymphadenopathy of the intrathoracic lymph nodes. In the case of systemic lupus erythematosus, the radiological semiotics are as follows: the process can also be symmetrical and asymmetrical, peripheral reticular changes, and lymphadenopathy of the intrathoracic lymph nodes and axillary group.
2. Thus, in patients with connective tissue diseases, such as rheumatoid arthritis, interstitial changes according to HRCT may correspond to usual interstitial pneumonia (UIP), which clinically and radiologically corresponds to idiopathic pulmonary fibrosis, nonspecific interstitial pneumonia (NSIP). NSIP proceeds more favorably since gross fibrous changes in the interstitium of the "honeycomb lung" type do not develop, which is very often characteristic of UIP.
3. Usual interstitial pneumonia is characterized by asymmetry and heterogeneity of the process - in one lung, there may be areas of normal and altered lung tissue (such as reticular changes, thickening of the peribronchovasal interstitium with the presence of traction and varicose bronchiectasis, etc.).
4. Nonspecific interstitial pneumonia is often characterized by symmetry and homogeneity of the process - in one lung, the pathological process is distributed symmetrically evenly.

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