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Original Article

Comparison of Lung CT Findings in COVID-19 Patients with Underlying Lung Disease and Healthy Cases

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Abstract

Introduction: COVID-19 pandemic produced a health predicament for the world in later 2019. The study aimed to compare lung Computed Tomography (CT) findings in COVID-19 patients with underlying lung disease and healthy cases.

Methods: Overall, 374 COVID-19 patients were included, that 49 (13.1%) patients had underlying lung disease. Chest CT outcomes were assessed in the positive reverse-transcription polymerase chain reaction (RT-PCR) assay cases referred to the Taleghani and Modares hospitals in Tehran from September 2019 to February 2020.

Results: The mean age of patients was 57.01±17.20 years old, and 222 patients (59.4%) were males. The mean age of patients was 65.83±16.59 years in Underlying lung disease cases and was 55.68±16.92 years in the control group (P<0.001). Lobes of the left lung were more affected by COVID-19 in both groups than the right lung. Also, there were no differences between groups in distributing of lobes involving (P>0.05). There was no significant difference between the two groups regarding distribution, density, internal stricture, fibrosis, effusion (P>0.05). The mean Lymph Node Para tracheal of patients was 9.43±2.56 mm in Underlying lung disease cases and was 120, 8.09±2.41mm in the control group (P=0.014). There was no significant difference between the two groups regarding carinal and Para aortic (P>0.05).

Conclusion: The results showed that underlying lung disease cases were older than the control group. Lobes of the left lung were more affected by COVID-19 in both groups than the right lung. Distributing of lobes involving, density, internal stricture, fibrosis, effusion, carinal and Para aortic were similar. The mean Lymph Node Para tracheal of patients was higher in Underlying lung disease cases than in the control group.

Keywords: COVID-19, CT Scan, Lung Disease.

Introduction

Coronavirus infectious disease caused by the Covid-19 virus began in December 2019 in Wuhan, China, became a public health emergency of international concern[1, 2]. Although these viruses usually infect other animals, they sometimes cause problems by mutant strains to humans [3-5]. Studies have demonstrated the clinical expressions of COVID-19 cases are fever, dry cough, breathing difficulties, headache, and pneumonia. Disease start may occur in progressive respiratory failure owing to alveolar injury and even mortality.

Detection of these viral infections is performed by virological methods such as PCR [6]. However, due to the unavailability of this diagnostic method, serological methods are usually used[7-9]. Also, chest CT scans can be considered a more accessible and efficient method for screening suspected cases[10, 11]. CT scans findings can help in the epidemic control of covid-19 and treatment of positive cases and further improve the prognosis and also reduce the transmission of the disease in the community[12, 13]. The conventional CT characteristic of COVID-19 cases is bilateral

peripheral GGO, particularly in lower lung lobes, whereas cavity, pure consolidation, tree-in-bud sign, and pleural effusion are not expected. The disease creates its specific images on a CT scan of the lungs. The findings of the Covid-19 pneumonia CT scan are predominantly GGO combination with consolidation, peripheral involvement, peripheral and central combination, involvement Bilateral, and lower zone conflicts. The study aimed to compare lung CT findings in COVID-19 patients with underlying lung disease and healthy cases.

Methods

Overall, 374 COVID-19 patients were included, that 49 (13.1%) patients had underlying lung disease. Chest CT outcomes were assessed in the positive reverse-transcription polymerase chain reaction (RT-PCR) assay cases referred to the Taleghani and Modares hospitals in Tehran from September 2019 to February 2020.

Parameters such as the involved lung segment, GGO, Architectural distortion, Reverse Halo, Crazy Paving, Pulmonary nodule, Consolidation, Mass, Distribution, Paranchimal Band, Vascular Enlargement, Bronchiectasis in Pulmonary HTN, Fibrosis, Pericardial Effusion, Pleural Effusion, Cavity, and Lymphadenopathy were collected. Covid-19 patients were divided into two underlying lung diseases and control groups. CT scans were acquired without any contrast medium, with the patients in the supine position and full inspiration, from the top of the shoulder through the mid-liver level. Patients underwent scanning with Somatom Emotion by acquisition parameters of 120 kVp; tube current modulation 100-200 mAs; spiral pitch factor, 0.75-1.5; and collimation width 0.625-5 mm. Imaging data were replaced with a medium sharp reconstruction algorithm at a slide thickness of 0.625-5mm. CT data were assessed in at least both lung (width, 1500HU, level -700 HU) and mediastinal (width 350 HU, level 40 HU) perspectives. CT scans were assessed by characteristics such as ground-glass opacity (GGO), consolidation, nodular pattern, architectural distortion, crazy paving, cavitation, revers halo sign, traction bronchiectasis, and interseptal thickening. Lobar involvement pattern as one lobe, bilateral (both lungs), multilobar in one lung, and all five lobes involvement were assessed. Each five lobes involvement percentage as five scores: zero for no involvement, 1 for lower than 25%, 2 for 26-50%, 3 for 51-75%, and 4 for more than 76% involvement were scored.

Statistical Analysis

Data analysis was done using SPSS-22. Data were expressed as mean, standard deviation, frequency, and percent. Data were analyzed by T-test and Chi 2 test according to a quantitative or qualitative model of them between the two groups. A P-value less than 0.05 was considered statistically significant.

Results

The mean age of patients was 57.01±17.20 years old, and 222 patients (59.4%) were males. The mean age of patients was 65.83±16.59 years in Underlying lung disease cases and was 55.68±16.92 years in the control group ($P<0.001$). There was no significant difference between the two groups regarding sex ($P=0.202$) (Table 1). The left lobes of the lung were more affected by COVID-19 in both groups than the right lung. Also, there were no differences between groups in distributing lobes involving ($P>0.05$). The left low lobe (LLL) and right middle lobe (RML) were the most and the least involved lobes in the Underlying lung disease group compared to the other ones, respectively. In both groups, all the lung lobes were involved in at least 50% of patients except for the right middle lobe (RML) in the control group, which showed lesions in 43.1% of patients (Table 1). There was no significant difference between the two groups regarding distribution, density, internal stricture, fibrosis,

effusion (P>0.05) (Table 1).

Table 1: Frequency of lobe involved, distribution, density, internal stricture, fibrosis, effusion in each group.

Items			Underlying lung disease	Control	P-value
Age, years			65.83±16.59	55.68±16.92	<0.001
Sex, M/F			25/24	197/128	0.202
Lobe involved	LLL	0	25 (51.0%)	131 (40.3)	0.142
		<25%	10 (20.4%)	58 (17.5%)	
		25-50%	5 (10.2%)	43 (13.2%)	
		50-75%	1 (2.0%)	47 (14.5%)	
		75-100%	8 (16.3%)	46 (14.2%)	
	LUL	0	25 (51.0%)	140 (43.1%)	0.65
		<25%	12 (24.5%)	69 (21.2%)	
		25-50%	6 (12.2%)	55 (16.9%)	
		50-75%	5 (10.2%)	49 (15.1%)	
		75-100%	1 (2.0%)	12 (3.7%)	
	RLL	0	25 (51.0%)	136 (41.8%)	
		<25%	12 (24.5%)	45 (13.8%)	0.060
		25-50%	4 (8.2%)	39 (12.0%)	
		50-75%	2 (4.1%)	50 (15.4%)	
		75-100%	6 (12.2%)	55 (16.9%)	
	RML	0	36 (73.5%)	185 (56.9%)	0.098
		<25%	4 (8.2%)	41 (12.6%)	
		25-50%	6 (12.2%)	39 (12.0%)	
		50-75%	0 (0.0%)	32 (9.8%)	
		75-100%	3 (6.1%)	28 (8.6%)	
	RUL	0	22 (44.9%)	129 (39.7%)	0.439
		<25%	15 (30.6%)	76 (23.4%)	
		25-50%	5 (10.2%)	55 (16.9%)	
		50-75%	6 (12.2%)	45 (13.8%)	
		75-100%	1 (2.0%)	20 (6.2%)	
Distribution	Peribroncovascular	Yes	21 (42.9%)	144 (44.3%)	0.849
		No	28 (57.1%)	181 (55.7%)	
	Peripheral, Yes/No	Yes	29 (59.2%)	204 (62.8%)	0.638
		No	20 (40.8%)	121 (37.2%)	
Density	MIX	Yes	1(2%)	6(1.8%)	0.629
		No	48(98%)	319(98.2%)	
	CON	Yes	5 (10.2%)	48 (14.8%)	0.393
		No	44 (89.8%)	277 (85.2%)	
	GG	Yes	43 (87.8%)	244 (75.1%)	0.050
		No	6 (12.2%)	81 (24.9%)	
Internal stricture	Septal tickening	Yes	5 (10.2%)	45 (13.8%)	0.629
		No	44 (89.8%)	280 (86.2%)	
	Cavitation	Yes	0 (0.0%)	2 (0.6%)	0.755
		No	49 (100.0%)	323 (99.4%)	
	air broncogram	Yes	4 (8.2%)	62 (19.1%)	0.070
		No	45 (91.8%)	263 (80.9%)	
Fibrosis	Band shadow	Yes	23 (46.9%)	157 (48.3%)	0.858
		No	26 (53.1%)	168 (51.7%)	
	bronchectasis	Yes	1 (2.0%)	8 (2.5%)	0.666
		No	48 (98.0%)	317 (97.5%)	
Effusion	Pericardial	Yes	1 (2.0%)	5 (1.5%)	0.572
		No	48 (98.0%)	320 (98.5%)	

The mean Lymph Node Para tracheal of patients was 9.43±2.56 mm in Underlying lung disease cases and was 120, 8.09±2.41mm in the control group (P=0.014). There was no significant difference between the two groups regarding carinal and Para aortic (P>0.05) (Table 2).

Table 2: Difference Between The Two Groups Regarding Carinal And Para Aortic

Items		Underlying lung disease	Control	P-value
Lymph Node	Sub carinal, mm	14, 8.32±2.61	127, 7.45±2.20	0.24
	Para aortic	2, 6.60±1.55	14, 7.39±2.24	0.68
	Para tracheal	20, 9.43±2.56	120, 8.09±2.41	0.014

Discussion

This study aimed to assess lung CT findings in COVID-19 patients with underlying lung disease and healthy cases. The left lobe of the lung was more affected by COVID-19 in both groups than the right lung. Also, there were no differences between groups in distributing lobes involving. There was no significant difference between the two groups regarding distribution, density, internal stricture, fibrosis, effusion. The Lymph Node Para tracheal mean was higher in the underlying lung disease cases than in the control group. There was no significant difference between the two groups regarding carinal and Para aortic.

Wang et al. (2020) showed the use of CT Scans should be with the lowest dose and frequency due to the possibility of imposing complications due to radiation and is used in areas where corona prevalence is high[14].

A retrospective study by Li et al. (2020) found that most COVID-19 patients had involvement in several lobes or bilaterally, which is 85% of cases was peripheral. Also, 15% of patients had Patchy lesions, and consolidation was found in 47% of patients by CT. Pleural effusions, thickening and hydrothorax, and lymphatic involvement were uncommon findings. In the follow-up CT scan, the lesions were removed in 73% of cases, with an average time of 3.5 days from the baseline. In this study, multifocal lesions associated with consolidation were declared highly suggestive[15].

A review study conducted by Majidi et al. (2020) showed in Covid-19 patients, consolidation in CT scan in 6 to 100% of cases, environmental conflict in 29 to 100%, bilateral conflict in 50 to 98%, multifocal involvement in 37 to 90% and ground glass involvement in 40 to 100% of patients[16].

Ostad et al. (2020) showed patch consolidation and environmental involvement, and ground-glass lesions are the main findings of CT scan in Covid-19 patients[17]. Ye et al. (2020) showed that Ground glass lesions and Consolidation are the most common CT scan findings in Covid-19 patients[18].

Lippi (2019) showed that chronic obstructive pulmonary disease (COPD) is associated with an increased risk of mortality in pneumonia and is associated with an increased risk of more than fivefold in severe Covid-19 infection[19].

A study on CT scan images of 55 cases in Iran showed right and left lower lobes are the most frequently involved lobes[20]. A meta-analysis study on 2,738 patients revealed RLL and LLL were the most involved lung lobes (87.21% and 81.41%, respectively)[21]. GGO was the most common result in most studies among different models[20-22].

Kunhua et al. classified subjects into two groups, severe and ordinary patients, and revealed that some patterns like linear opacities, bronchial wall thickening, lymphadenopathy, and pleural/pericardial effusion are more common in CT imaging of severely ill subjects who can be considered as a predictor of severity and weak prognosis[22].

A study in Wenzhou, China, demonstrated that lymphadenopathy and pleural effusion with an incidence rate of 4.9% and 7.2% of participants, respectively are rare patterns[23].

Also, the presence of rare CT imaging features similar pulmonary nodules, cavities, lymphadenopathy, and pleural effusion in our

sample are compatible with some other studies. Moreover, reticulation, cavitation, pleural effusion, bronchiectasis, and lymphadenopathy were limited conditions in COVID-19 cases[24-25].

The fibrous lesions and fibrosis stripes are other models described in some CT images. Siyao et al. showed 44.8% and 36.8% of discharged patients had fibrous lesions and fibrosis stripes, respectively, are to our results, that pulmonary fibrosis was only found among recovered participants[26].

A meta-analysis study showed that the crazy-paving pattern is a significantly more common pattern in severe than non-severe patients. But, there was no difference between recovered and deceased groups. Comparing the number of included participants in our study with the previous meta-analysis, it seems that a crazy-paving pattern might be used as an indicator of severity in large populations[27].

Conclusion

The results showed that underlying lung disease cases were older than the control group. Lobes of the left lung were more affected by COVID-19 in both groups than the right lung. Distributing of lobes involving, density, internal stricture, fibrosis, effusion, carinal and Para aortic were similar. The mean Lymph Node Para tracheal of patients was higher in Underlying lung disease cases than in the control group.

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Conflict of Interest Disclosures

There is not any conflict of interest in this study.

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Authors' Contributions

All authors contributed in this study equally.

Ethical Statement

The proposal of this study confirmed by ethical committee of Shahid Beheshti University of medical sciences, Tehran, Iran.

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